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"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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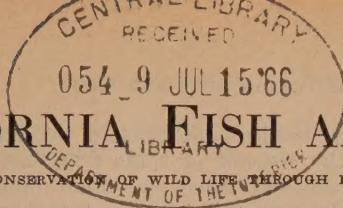
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PIUTE TROUT *SALMO SELENIRIS* SNYDER

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SACRAMENTO, APRIL, 1934

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A NEW CALIFORNIA TROUT

By JOHN O. SNYDER



THE REMARKABLE galaxy of brilliantly colored California trout has been enlarged by the addition of another which takes a conspicuous place amongst its fellows. It is named *Salmo seleniris** for a fancied resemblance of its evanescent tints to the lunar rainbow. Piute Trout has been suggested as a common name, recalling other aboriginal inhabitants of the region in which it is found.

* A brief description of the species appears in the Proceedings of the California Academy of Sciences, Fourth Series, Vol. XX, No. 11, pp. 471-472, Nov. 16, 1933. In the parlance of trinomial nomenclature this form would be called *Salmo henshawi seleniris*. The writer can see no particular advantage in writing the name thus. Here it leads to no better understanding of relationships, and elsewhere if trinomials are used in relation to western trout their application will often have to be based on mere speculation.

The newly described species is an isolated variant of *S. henshawi*, differing markedly in the absence of spots from the body, the more slender form and the relatively small and more numerous scales.

The outstanding characteristic of this trout is the color, well portrayed in the reproduction of a painting by Chloe Lesley Starks. No two observers agree in a description of its colors, tints and shades, some of which seemingly come and go with every changing whim of the fish. Moreover, its swimming movements are often accompanied with opaline reflections of varied intensity, and the skin in some places has a peculiar translucent appearance, so much so that on the head some of the cranial bones are partly outlined through the overlying tissue. A sudden disturbance will occasion the appearance of much green color on the body, thus imparting a greenish olive to the dorsal surface and a paler green to the region below the lateral stripe. The ventral surface may at times darken considerably.

The normally clear white ventral surface is unusual, particularly on the throat where it forms an advantageous background for the extensive orange red areas beneath the mandible. As in the case of other cutthroats, an occasional example bears one or more small, golden, coin-like spots, located anywhere, but usually on the ventral surface. There are no dark spots on the body and they are not numerous on the dorsal and caudal. In some examples the caudal is almost immaculate. The major parr marks are ten in number, the first immediately bordering the gill opening, the last at the end of the caudal peduncle. All are crossed by the lateral line, the posterior ones bisected by it, the anterior ones two-thirds below. Of the secondary row, sixteen in number, every alternate spot dips between the nearby primary ones. The mid dorsal region is marked by a narrow dark line.

The body is comparatively long and slender, so much so as to attract attention at once. The fins are rather weak.

Proportional measurements were made of each of ten specimens of *S. seleniris* from its restricted habitat presently to be described, and also from a like number of *S. henshawi* from Silver King Creek, a tributary of Carson River. Averages of each ten are here given, the column marked "S" representing *S. seleniris*. Considerable difference appears, particularly in the depth of the body.

	S.	H.
Standard length in millimeters	160.4	161.7
Length head in hundredths of standard length	.254	.262
Depth body	.198	.235
Depth caudal peduncle	.099	.110
Length caudal peduncle	.159	.164
Length maxillary	.141	.147
Length snout	.065	.068
Diameter eye	.05	.049
Interorbital width	.078	.077
Depth head	.163	.165
Snout to occiput	.172	.167
Snout to dorsal	.508	.514
Snout to ventral	.549	.547
Length base of dorsal	.123	.144
Length base of anal	.108	.112
Height dorsal	.155	.160
Height anal	.149	.145
Length pectoral	.166	.179
Length ventral	.138	.145
Length caudal	.198	.215
Dorsal rays	10.0	10.8
Anal rays	10.6	10.3
Scales lateral series	170.9	167.6
Scales above lateral line	30.1	29.7

Scale counts from ten examples each from the following localities are given for comparison.

	Lateral series	Above lateral line
Lake Tahoe near Tallac-----	156 to 170	31 to 35
Truckee River near Thisbe-----	157 to 165	30 to 34
Pyramid Lake-----	153 to 162	29 to 35
<i>Salmo seleniris</i> -----	168 to 176	29 to 31

Fish 6 to 8 $\frac{3}{4}$ inches in length appear to be about three years old. The growth is rapid during the season of active feeding.

This trout is found only in the little streams of Fish Valley, a remote region in Alpine County east of the Sierra Divide. Its native habitat is restricted by Llewellyn Falls which form an impassable barrier between the waters above and Silver King Creek below, which in turn flows into Carson River. The waters of the latter eventually disappear in Carson Desert to the eastward. Carson River was once tributary to the Quaternary Lake Lahontan which covered a considerable area in Nevada. Its fishes are therefore related to or identical with those of other rivers as the Truckee, Walker and Humboldt which were also tributaries to the same ancient lake. This region or basin, the streams of which have not had any connection with the ocean for untold ages, contains native representatives of both the rainbow and cutthroat trouts. The rainbows are *S. regalis* of Lake Tahoe, *S. smaragdus* of Pyramid Lake, and *S. aquilarum* of Eagle Lake. *S. henshawi*, the more generally distributed trout is a cutthroat, and its relationships are apparently with similar trouts of the upper Columbia and Snake rivers and Salt Lake Basin. The native trout of the Colorado is related to these.

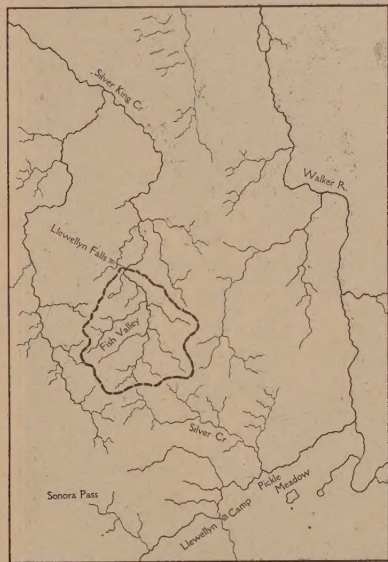


FIG. 20. Sketch map showing Fish Valley habitat of the Piute trout.

Trout from below the falls are different from those immediately above in that their bodies and dorsal and caudal fins are well covered with large and very conspicuous roundish black spots. They are also considerably deeper and more robust in appearance. The colors are not nearly so bright. An enumeration of the spots on several examples from the stream below the falls will be of interest.

Spots on side of head-----	10	18	5	5	4	5	6
On body above lateral line-----	32	93	38	58	37	36	22
Body below lateral line-----	25	57	34	17	34	8	33
On tail above lateral line-----	20	36	26	24	12	19	17
Tail below lateral line-----	18	21	19	13	17	9	17
On dorsal fin-----	33	34	38	41	25	28	30
Caudal fin-----	55	66	67	21	33	13	43

All trout of this species found elsewhere in the Lahontan Basin are similarly spotted. An enumeration of the spots of several specimens follows:

Locality	Lake Tahoe		Truckee River				Pyramid Lake		
Spots on side of head-----	55	60	16	12	44	68	65	20	13
Body above lateral line-----	95	103	100	44	115	92	102	51	43
Body below lateral line-----	113	53	45	49	175	159	121	16	0
Tail above lateral line-----	43	45	48	39	63	59	52	42	40
Tail below lateral line-----	59	44	25	31	57	82	56	28	7
On dorsal fin-----	36	42	86	103	55	45	66	52	41
Caudal fin-----	66	93	234	284	145	162	184	65	95

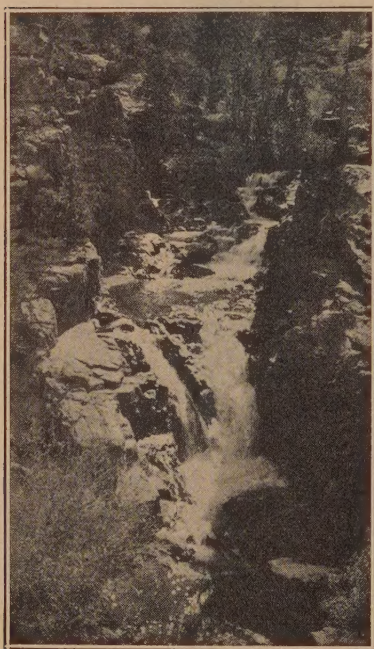


FIG. 21. Llewellyn Falls, the barrier which prevents the passage of trout of the species *Salmo henshawi* into the basin occupied by *Salmo selentris*. Photo by E. L. Macaulay.

These fish measured from $14\frac{1}{2}$ to $28\frac{1}{2}$ inches in length. The spots of *S. henshawi* are so numerous, large and conspicuous that the species is commonly referred to by hatchery men as the black-spotted trout.

Recognizing that the trout above Llewellyn Falls may be regarded as members of a species which is different from that below, one asks concerning their origin and the means by which they arrived. The immediate and only answer is that they have been there as long as any trout have been in the Carson Basin. The falls are of more recent origin than the trout. Before the falls became a barrier to free migration, the trout of the streams of Fish Valley were not different from others in the river below. When the falls became an obstruction to the passage of fish those above became insular. Some of their number might occasionally drift down over the falls to be ultimately lost in a large population, but none from below could ever mingle with those above.

It is a well-known biological principle or law that insular or isolated animals tend to vary or change from the parent stock. Just why they may vary in any particular way is a matter for speculation. It is not possible at present and in this particular case to account for the unusual brilliancy of color, or for a loss of the black body spots. Whatever else may be said, the significant thing is that we have here an exceptionally good illustration of variation through isolation. The habitat of the species is sharply defined, the barrier which protects it is perfectly evident, and the parent stock from which the

species was derived is in an immediately adjacent region. Moreover, the principal distinguishing character, color, is evident at a glance. Furthermore and of particular interest is the fact that the differentiation of this trout from its parent form is parallel in some respects with that of the golden trouts west of the Sierra divide. The outstanding characteristics of these trouts, *S. roosevelti*, *S. whitei* and *S. aguabonita* are brilliant color with much yellow, a reduction in the number of spots, notably in *S. whitei*, and a very definite increase in the number of scales on the body. These trouts are presumably isolated variants of the coast rainbow, *S. irideus*. The scales of the latter number 120 to 150 or so in the lateral series, while those of the golden trouts are as high as 200.

Thomas R. Hanna first called my attention to the peculiar trout inhabiting Fish Valley in a letter which runs thus: "Fish Valley is the most southerly meadow on Silver King Creek, the most easterly tributary of Carson River. Silver King Creek is a small stream that may be crossed dry shod most times of the year. It has its source above Fish Valley from the deep snow banks that collect during the long alpine winters in the deep glacial cirques of the high Sierra summits. Small streams from these snow banks unite and flow down a steep and shaded glacial gorge for several miles before they emerge into the smooth, green and treeless meadow of the Valley. Fish Valley is about two and one-half miles long. The stream flows between overhanging sedgy banks over a granite gravel bottom for twice as far in its meanderings down the Valley.

"The Valley stream has a multitude of medium size trout that are native to the stream and differ from any that I have ever seen. They rise readily to any kind of fly, irrespective of the season or the amount of native food that may be available. Their basic color is lemon yellow with brown heads, tails and dorsal fins. They lack the characteristic spots that are on all trout, and instead they have a series of soft light brown vertical bars on their sides. Their bellies are ivory white with a brilliant patch of scarlet under their throat and gills. On each side a thread-like scarlet line runs from their gills to their tail. In their native water, they appear quite transparent and are difficult to see. When first caught, they are a rich bronze color with an iridescent sheen, reflecting their yellow, red and brown tones like the play of colors in a Mexican fire opal. They lose this beauty and tend to darken after they have been out of water. Their meat is white, of fine texture and very delicate. I believe they spawn in the fall of the year.

"That these fish live in such a small stream together with the fact that they are so easily caught dooms them all to an early extinction unless they are adequately protected. To protect them, I believe that all of Silver King Creek and tributaries above its junction with East Carson River in Silver King Valley should be closed at once."

Because of the inaccessibility of Fish Valley, it was found necessary to catch and transport living fish to some place where the artist might make a satisfactory study of them. In cooperation with the officials of Steinhart Aquarium, this was accomplished. As a preliminary, Roland Dobler and Walter Thornburg of the State Division

of Fish and Game successfully caught on August 23, 1933, and transferred upwards of 150 fish to the Alpine Hatchery near Markleeville. These were fed and held in troughs for a time without loss and ultimately preserved as the type and paratypes (September 17). Later the same men packed many more out of Fish Valley to Pickle Meadow and delivered them to William Martin of the Steinhart Aquarium who brought them to San Francisco (October 3). A few days later Dobler and Thornburg followed with a small truck of live fish and delivered them also to the Aquarium. At this date, these fish are still on display and in fine condition.

In a brief letter recounting the work, Dobler writes: "The trip from Pickle Meadow to Fish Valley, a distance of 14 miles, can be made in about five hours with pack stock. On arriving in the Valley we made our camp and later distributed our empty pack cans along the creeks. In fishing we placed the ones caught in a bucket until there



FIG. 22. Summit of the pass from Pickle Meadow, looking toward Fish Valley on the right. Photo by E. L. Macaulay.

were several and then carried them to the nearest pack can. The latter was then partly submerged in the creek to insure a circulation of water in the can, where it could remain until we were ready to come out.

"The fish strike the fly very hard, doing most of their fighting under water, darting every way in trying to get free, and not breaking water very often. When a fish missed a fly, it would break water, turning back on its side instead of moving on in a forward direction. A royal coachman No. 12 hook seemed best. They are game fish and one of the best flavored that I have eaten."

Thornburg writes: "Because of automobile trouble, I arrived at Pickle Meadow a little too late to join the pack train. Leaving the meadow at 2 p.m. with my bedding, I took up the trail leading along Silver Creek for some nine miles up the steep mountain sides. I stopped on the summit long enough for a sigh of relief, and then

headed down the opposite slope toward Fish Valley some six miles away. Arriving at seven, I found Dobler camped at the head of the Valley with preparations for dinner in full swing, certainly a most welcome sight to me. With a good meal disposed of and a hard hike of 14 miles behind me, a sound sleep followed.

"Arising early the following morning, we were soon out to get the fish. Fishing hard for some time and with little success was disappointing when around 10 o'clock they began to strike. By the middle of the afternoon, a rain drove us to cover and we spent some time by a little fire. The rain slacking, we were out again and by nightfall we had around 100 trout.

"Early Monday morning (October 2), we loaded the packs and fish cans on the horses and started fishing again, adding 20 or more fish to our catch. We left the Valley at noon and by three in the afternoon, we delivered the fish to the holding pond in the West Walker.

"We then went to Bridgeport for a night's rest. Leaving there early on Tuesday, we returned to Pickle Meadow from where we again packed over into Fish Valley to try our luck once more with the trout.

"Early Wednesday morning we found the fish striking well and it was not long before 10 or 12 trout would be in the pail and we would have to hurry for one of the cans which we had located along the stream.

"I used a fly most of the time although in one pool I baited it with pieces of grasshopper with good results.

"These trout strike the fly very well and seem to be a little faster than the regular black-spotted ones, but not so lively as the rainbows. They are not very easily frightened. Many times while walking along the banks, I saw a fish leave the shallows and move to deeper water, when after a few casts he would rise to the fly and even come back several times if not hooked. In one pool where there were six or so in sight, I hooked one about eight inches in length. It fell off on the edge of the bank and finally escaped into the water. After taking a couple from the pool, this same trout tried it again and before long managed to join the collection. On this day, I succeeded in taking 77 trout, getting them safely into the cans.

"It seemed to make little difference whether a man led or was in the rear, he had about the same good luck. They seemed to take the fly as well in the bright sun as in the shady places.

"Upper Fish Valley is a wild mountain meadow through which the stream winds back and forth and has many pools. The sides of the Valley rise very steep to some two thousand feet. After leaving the Valley, the stream becomes much faster and the banks are lined with willows. There are many soda springs along the stream.

"The falls are over granite rocks and they have some 20 feet of perpendicular drop. The water falls on a sloping apron of granite and soon enters a narrow gorge after which the stream opens into Lower Fish Valley. Here the stream keeps to the west side and it is bordered by willows and has many fine pools. Fish are more plentiful here. On leaving the lower Valley, the stream narrows, presenting much very fast water and many splendid pools. When it reaches Silver King Valley, it slows up again to its entrance into East Carson River.

"We left Fish Valley October 5 and on the sixth we started for San Francisco with the fish on a small truck and delivered them at nine o'clock on the following morning without the loss of a fish. They were all full of pep."

Most of us will take off our hats to such anglers.

Some fishermen protest against a size limit, contending that hooked fish can not be safely returned to the stream. Here is presented a case where several hundred fish of various sizes were caught, transported considerable distances and finally kept for a long time under adverse conditions and without material loss.

As this region presents an apparently clear cut and unusual biological demonstration in nature, everything within reason should be done to preserve it so. As no trout have ever been introduced into Fish Valley, it is proposed to preserve the purity of the native stock by keeping it free from foreign introductions or artificial propagation. This policy will not prevent the transfer of fish of the species elsewhere if it seems desirable for practical or experimental purposes.



FIG. 23. Fish Valley above Llewellyn Falls, the habitat of *Salmo seleniris*. Photo by E. L. Macaulay.

STREAM IMPROVEMENT

By A. E. BURGHDOFF

Stream improvement is a phase of conservation that is receiving much attention at the present time. In a general way, the subject may be divided into two classes of endeavor: first, retardation of stream flow by the construction of weirs or erosion dams; second, storage of water near the source of streams, to be released in a continuous quantity sufficient to maintain stream flow during that portion of the year when streams would normally be very low or dry.

The first type of improvement is particularly adaptable to spring-fed meadow streams and undoubtedly the carrying capacity of such streams can be greatly increased by this method of improvement. It is this type of construction which makes possible effective stream improvement in the Eastern States. Improvements of this kind do not fit conditions existing in most of our western streams, where precipitous rock-bound streams fall thousands of feet in a score of miles. What the western type of stream needs is an equalizer to insure constant flow and this can be accomplished by the second class of improvement.

In many instances, and at moderate cost, water can be stored near the source of streams in sufficient quantities to insure ample flow during that part of the year when streams are dangerously low or entirely dry. Climatic conditions in California which cause streams to go dry during the late summer, entails the loss of millions of young trout, possibly more than our total hatchery output. If these annual losses are added to those brought about through agricultural and hydro-development, it indicates that every effort must be made to counteract these conditions wherever possible.

The Cherry Creek project in Tuolumne County demonstrates the possibilities of this method of stream improvement in this State. This is a typical granite area in the High Sierra, differing only in location from scores of similar areas where like results may be obtained. This area was originally barren of fish life. Many years ago settlers and stockmen carried trout from Laurel Lake, now included in Yosemite National Park, and placed them in some of the streams and lakes in this area. These fish thrived and increased until excellent fishing was to be had in several of the lakes and streams in the early season. There are no springs in the high granite country and when the surface water runs off, the streams dry up and the lakes recede. As long as seasons of normal rainfall continued, conditions were favorable and the fish needed no assistance to maintain their abundance. When the prevailing dry cycle of years started in the early twenties, the normal run-off was gone long before the first fall rains commenced, with the result that fish in the streams were lost and the carrying capacity of the lakes greatly reduced.

Two sportsmen, F. W. Leighton and W. E. Burnham of Sonora, had a summer cabin near a small lake at the base of Mt. Gillett. They stocked this lake with fish carried there in old oil cans. Their problem

was to make the lake self-sustaining and this was accomplished by going up the canyon a few miles and building an earth and rock dam at the outlet of a group of lakes about fifty acres in extent. The storage water thus impounded was ample to insure a good flow of water below the dam and to permit the trout in the lake below to ascend the stream to spawn and insure that the young fish could find their way back into the lake. This lake thus became self-sustaining and a movement was started to have similar projects commenced on a more elaborate scale.

In the late summer of 1930, the writer together with F. W. Leighton and J. R. Hall, Supervisor of the Stanislaus National Forest, made a survey to determine the feasibility of constructing similar dams near the source of Cherry Creek tributaries. At this time, all of the upper

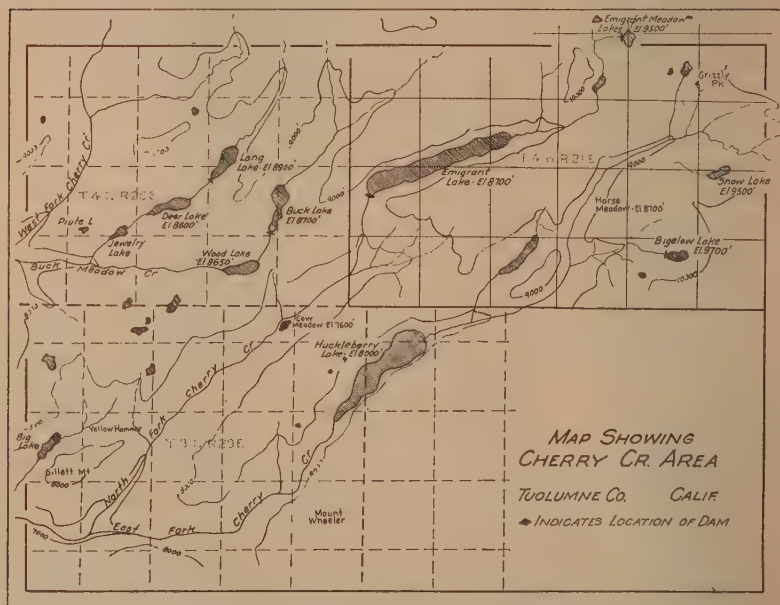


FIG. 24. Cherry Creek area, Tuolumne County, showing location of dams regulating stream flow.

tributaries to Cherry Creek were dry except for pools in some of the meadow sections. It was probable that even these pools would disappear before the first fall rains. Considerable numbers of trout of various sizes were stranded in these pools, an annual occurrence which resulted in heavy losses.

Cherry Creek divides into three main branches, the West, North and East forks. As a result of the 1930 survey, storage dams were built on each of these branches.

Control storage on the West Fork is accomplished by dams on Long and Buck lakes; the water released from Long Lake passes through Deer and Jewel lakes. From Buck Lake it passes through Wood Lake and combining with water from Long Lake, flows two



FIG. 25. The Buck Lake Check Dam is eight feet high and 56 feet long.
Photo by Louis Jensen.



FIG. 26. Main Check Dam on Long Lake, Cherry Creek project. This dam is eight feet high and stores 520 acre-feet of water. Photo by Louis Jensen.

miles into West Fork at the upper end of Louse Canyon. These storages maintain a constant water level in the lakes through which it flows and a good stream of live water from the storage lakes to the junction of the West Fork with the main Cherry. The flow through Louse Canyon September 18, 1933, was about 60 miner's inches. The lakes and streams in this chain are well stocked with trout and many small fingerlings of this year's hatch were observed. It is not known whether any available storage exists above Buck Lake. If so, an ideal permanent spawning area in the stream channel above this lake could be developed, where all natural spawn is now lost through lack of continuous stream flow.

The center or North Fork chain of lakes includes dams at Emigrant Meadow Lakes and Emigrant Lake. The latter, on account of its large storage capacity, is the key control to the entire watershed project; with the construction of a 24-inch top extension on this dam, the storage will provide a minimum flow of 80 miner's inches or more, the full distance to the junction of Cherry and Elinor creeks. Emigrant Meadow Lakes furnish sufficient storage to adequately protect the spawning areas above Emigrant Lake and to insure natural reproduction in the latter.

About three miles below Emigrant Lake the stream enters Cow Meadow. This meadow is several miles long and for much of the distance fine gravelly spawning beds exist. A canal-like lake about one mile long and ranging from 50 to 100 feet wide and up to 4 feet deep is situated at the lower end of the meadow. It is proposed to construct a low erosion dam at the lower end of this canal, to raise its water level 24 to 30 inches. In addition to deepening this canal, raising the water level 24 inches will connect up a 15 acre lake which is about 18 inches higher than the present water level in the meadow. This lake is now barren but will become a valuable stocking reservoir when connected with the creek system. The results of the 1931 construction are very pronounced in Cow Meadow. It has never been my privilege to see any section of stream better stocked with fingerlings and one and two year old trout than is this section. One has to see these results to fully appreciate the accomplishment.

The East Fork chain lacks sufficient storage. A dam at Bigelow Lake supplies live water into Huckleberry Lake at all times but the evaporation in Huckleberry Lake is greater than the inflow will replace, resulting in the stream below Huckleberry Lake to its junction with the North Fork going dry. Storage at Snow Lake, located $2\frac{1}{2}$ miles northeast of Bigelow Lake, would supply the necessary water to offset evaporation in Huckleberry and would also open up two miles of excellent spawning area in Horse Meadow. In addition to a storage dam at Snow Lake, an erosion dam should be built at the lower end of Horse Meadow and a low flat dam at the lower end of Huckleberry Lake to prevent excessive early runoff of surface water.

Regulation of water discharge from these storage dams is accomplished in a simple manner which does not require frequent adjustments. A gate valve, which can be locked in any position, allows for an opening which will pass a predetermined flow of water. The valves are then opened to this extent and remain so at all times. When dams are full and water flowing over spillways, a portion of the surplus water

necessarily passes through the valve. This flow continues after water has receded below the spillway level and assures a continuous discharge.

The type of construction of these dams is determined by the character of the lake outlet, but in general it consists of a rock and concrete wedge built into the narrow lake outlet. Only lakes where the outlet is narrow and wedge-shaped are selected for storage in order that material requirements shall be limited. Rock walls are built up to the required height and each side of the wall is then tied in with concrete. Walls at the base are one-half as thick through as the height of the dams and taper to twenty-four inches at the crest. The valves are placed in the lower center with the locking control stem extending to the crest of dam.

From the nature of this project and its indicated success, it will likely become an example of what can be accomplished in the high



FIG. 27. Huckleberry Lake. Looking upstream. Photo by Louis Jensen.

granite areas of the Sierra in water storage and fish conservation. From its permanency, it insures economical administration and is undoubtedly an outstanding conservation achievement. If the recommended 1934 construction is done, the Cherry Creek area project can be considered completed. Additions and improvements to the system will present themselves from time to time, but the main objective, insuring a constant flow of water in Cherry Creek and its tributaries will have been accomplished, and about 70 miles of live trout stream restored.

During the 1933 season, a C.C.C. subcamp was established on the upper Clavey River at Bear Lake in Tuolumne County. This camp, under the jurisdiction of Supervisor Hall, constructed a rock-concrete dam at the outlet of Bear Lake and, at this date, September 23, 1933, is engaged in constructing another at Y Meadows, 3 miles above. The combined storage of these two projects will be about 500 acre-feet,

sufficient storage to keep this fork of Clavey River alive throughout the year. The meadow storage will insure natural spawning areas above Bear Lake while the combined release will provide for natural reproduction through about 17 miles of average spawning stream. This should result in good stocking of the lower portion of the Clavey River. The work done by the C.C.C. men is of excellent quality and is permanent in nature.

The following cost and operation chart indicates the moderate cost of these projects and the accompanying photographs show the general type of construction employed.

COST AND OPERATION OF CHERRY CREEK DAM PROJECT

Name of Lake	Eleva- tion	Area in Acres	Release miner's inches	No. days protec- tion	Storage capacity, acre-ft.	Valve opening number of turns	Cost	Days to build	Sacks of cement used
Bigelow -----	9,800	59	80	100	460	9	\$1,128	17	51
Emigrant -----	8,850	213	150	120	1,491	12½	788	12	38
Emigrant Meadow--	9,750	23	50	90	160	5	852	13	65
Buck -----	8,400	48	70	100	360	5	1,416	24	70
Long -----	8,700	67	80	130	520	7	1,016	15	56
Totals -----	----	410	430	540	2,991	--	\$5,200	81	280

NOTES ON THE FOOD OF TROUT*

By P. R. NEEDHAM, PH.D., Associate Aquatic Biologist, United States Bureau of Fisheries

With seven photographs by the author

Trout foods are normally derived from two sources, the water itself, and the adjacent land. Any angler who has lifted stones or sticks from the bed of a permanent stream has seen the great array of organisms present. Underwater foods include a host of aquatic insects such as caddis-fly, mayfly, or stonefly larvae and nymphs, beside numerous shrimp, snails, and fishes. Counts of submerged trout foods from given areas have shown insect foods to average over 7835 in number per square yard in certain coastal streams in California. On the other hand, land foods eaten by trout are mostly insects or other terrestrial animals that are blown or fall into streams accidentally. Water living food organisms are available to trout the year round, while in localities where winter is severe, land foods will be abundant only during the warm summer months.

Many anglers open stomachs to see what trout have been eating and use their observations as a guide in the selection of lures. The varied assortment of bugs in most stomachs and the difficulty of identifying them properly due to their small size usually leads anglers to conclude that the trout are bottom feeding and hence, they should turn to bait or sunken fly to stimulate their gastronomic interests.

In the course of the work of the California Trout Investigations we have had occasion to examine microscopically many stomachs** of rainbow and Loch Leven trout and below are presented a few of our observations along this line that may prove of interest to anglers. In no sense is this data intended to show how to overcome a trout's critical taste for our feathered offerings, but instead, may serve to point out a few interesting dietary idiosyncrasies along with some observations on the food organisms themselves.

In Table 1, it is shown that the dominant food of young steelhead trout from the coastal stream, Waddell Creek, were caddis-flies, over 50 per cent of all items eaten belonging to this group. Of the 557 eaten, only one was eaten in the adult stage at the surface of the water. All the rest were taken as larvae or pupae below the water surface where they normally live in their immature stages.

* Published by permission of the U. S. Commissioner of Fisheries.

** Thanks are due Francis Sumner of the staff of the Trout Investigations for his help in both field and laboratory work herein reported. Permission to collect trout for scientific purposes at all times was granted by the Division of Fish and Game.

Table 1. Foods Consumed by 22 Steelhead Trout from Waddell Creek, Santa Cruz County *

Class of food	Number found in 22 stomachs	Per cent of total
Caddis-flies	557	50.54
True-flies	400	36.29
True bugs	56	5.08
Beetles	53	4.82
Ants, bees, wasps	13	1.17
Miscellaneous	23	2.09
Total	1,102	

* Fish taken August 9, 10, 1933. Average length, 4 inches; maximum, 6.9 in., minimum, 2.6 in.



FIG. 28. Caddis-fly larva, *Limnophilus*, removed from its case. Natural size.

Caddis-flies (*Trichoptera*) are probably the most important single trout food in streams. They are abundant in coastal and Sierran streams. A few inhabit lakes.

The life cycle of a caddis-fly is as follows: the female flies lay their eggs in water. These hatch into larvae which live from several weeks to months in the stream bed and then change to pupae and emerge from the water as adults, thus completing the cycle. Large numbers of adults emerging from the water at the same time constitute the so-called "hatches" of anglers. "Salmon flies" which emerge in large numbers at times, are members of the stonefly group, though emerging caddis-flies and mayflies are often termed "salmon flies."

Caddis-fly larvae and pupae generally live in conspicuous fixed or portable cases (Fig. 28) made of bits of bark, sand grains, twigs, etc. The larvae may always be recognized either by their cases or by the pair of hooks found at the posterior end of the body. Trout often eat caddis larvae, case and all, and many stomachs contain large amounts of debris from materials that formed the cases. Many anglers collect caddis larvae, remove them from their cases, and fish them as bait.

The second most important item was the two-winged or true-flies (*Diptera*) which formed 36.29 per cent of the total foods eaten. These have a life cycle similar to the caddis-flies in that egg, larvae, and pupal stages are passed in the water. Only 20 of the 400 flies eaten were taken as adult or so-called "dry" flies, 380 being secured as larvae and pupae below water. These larvae are readily recognized by their worm-like form, lack of legs, and apparent lack of a definite head (Fig. 29). Most of the true-flies eaten belonged to the family *Chironomidae* or midges. Their aquatic stages are abundant in streams and lakes, cold or warm water, and furnish one of the staples in the diet of young fishes. In size they are usually from one-eighth of an inch to an inch in length. Many of the larvae are often blood-red in color whence they derived the name "Bloodworms."

True bugs (*Hemiptera*) were the third most abundant food eaten, forming slightly better than 5 per cent of their diet. Part of these organisms were aquatic "water striders" that skip about on the surfaces of pools and a portion of them were strictly terrestrial forms such as leaf hoppers that had fallen into the water from vegetation on the banks of the stream.

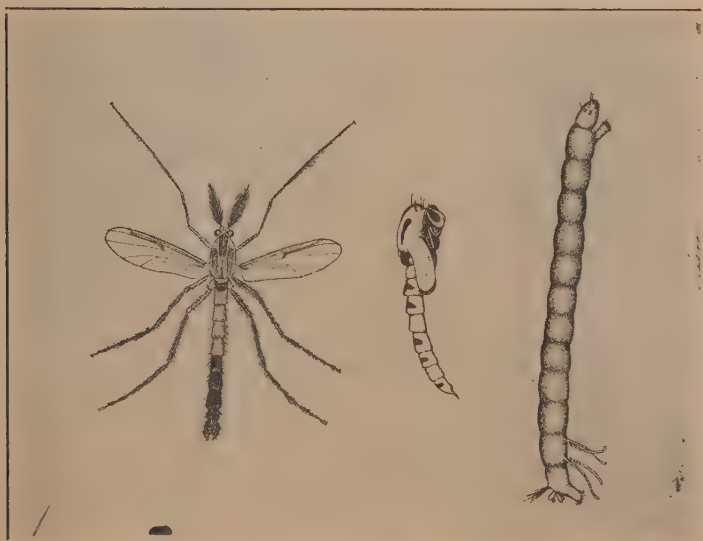


FIG. 29. Midge. Left to right, adult, pupa, larva. Six times natural size.

Of the 53 beetles eaten, 18 were aquatic forms—diving beetles, riffle beetles, etc.—and the remainder mainly ground and bark beetles that had fallen into the water. The few ants, bees, and wasps found in the stomachs were all typically terrestrial forms. Included in the "miscellaneous" column in Table 1 are five mayfly and four stonefly nymphs, one grasshopper, a few mites and spiders.

Of the total 1102 items eaten, over 87 per cent were aquatic in origin and consisted, as pointed out above, largely of aquatic insects

which normally live in the water. The remaining 13 per cent were terrestrial in origin that had fallen into the water accidentally.

If we now examine the food of trout from a typical mountain stream such as the Merced River, certain marked differences in the selection of food becomes evident.

In Table 2 is summarized the food of 10 rainbow trout taken recently in the Merced River on the floor of Yosemite Valley.* Instead of caddis-flies being numerically dominant in the stomachs, we found leaf hoppers to predominate along with beetles, there being almost as many of the latter as of the former in the ten stomachs.



FIG. 30. Larva and adult of riffle beetle. Twelve times actual size.

Table 2. Foods Consumed by 10 Rainbow Trout from the Merced River in the Floor of Yosemite Valley *

<i>Class of food</i>	<i>Number found in 10 stomachs</i>	<i>Per cent of total</i>
Leaf hoppers -----	294	35.46
Beetles -----	293	35.34
True-flies -----	108	13.02
Caddis-flies -----	61	7.35
Mayflies -----	22	2.65
Stoneflies -----	21	2.53
Miscellaneous -----	30	3.63
Total -----	829	

* Fish taken Oct. 31 and Nov. 2, 1933. Average length, 5.5 inches; maximum, 8.3 in., minimum, 4.05 in.

Leaf hoppers are small insects, usually less than a quarter of an inch long, often green in color, that live by the thousands on leaves of trees and grasses adjacent to streams. Naturally, when as abundant as they were this year, many fall or are blown into the water. As many as 104 occurred in a single stomach and only one failed to contain any at all.

* Thanks are due C. G. Thomson, Superintendent of Yosemite National Park, for his hearty cooperation in furthering our field investigations in the streams and lakes of the Yosemite region.

The great majority of beetles eaten were aquatic, most of them being either larvae or adults of riffle beetles (Fig. 30) that live in the gravel beds in swift water. A few, 35 of the 293 beetles eaten, were typical land forms and nonaquatic. This is a surprising find and is the only instance in the hundreds of stomachs I have examined where riffle beetles formed a major portion of the food. A few other aquatic beetles were eaten, such as diving and whirligig beetles, and are included in the figures given here.

True-flies found in these rainbow trout formed only 13.02 per cent of the total foods, while it will be recalled that in the young steelheads



FIG. 31. Nymph of stonefly (Salmon-fly), *Pteronarcys*. One and a half times natural size.

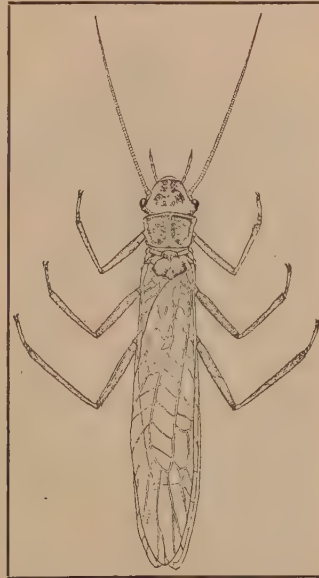


FIG. 32. Adult stonefly (Salmon-fly), *Pteronarcys*. Common in streams of northern California from early June to late August. Drawing by Miss Helen Thorsen. One and a half times natural size.

they formed approximately 36 per cent. Of the 108 flies, exactly 100 were typically aquatic larvae and pupae, only eight being secured as adults after they had left the water.

Caddis-flies which ranked first in numbers in the young steelhead trout, here rate but fourth place (7.35 per cent) and all of them eaten were immature larvae and pupae.

About equal numbers of mayfly and stonefly nymphs (Figs. 33 and 31) had been eaten and are surprisingly low, for members of both groups are abundant in the Merced River as shown by our bottom collections. Most anglers believe mayflies and stoneflies to be major foods of trout and large numbers of artificial flies are patterned after these insects. Mayflies often are eaten in large numbers but stoneflies or "salmon flies," as they are usually called, are extremely "spotty"

in their distribution and actually far fewer of these are eaten, on the average, than is generally supposed. In California, the large "salmon fly," *Pteronarcys californica* (Fig. 32), is abundant in streams north of Lake Tahoe and in coastal streams north of San Francisco, but is rare or absent in many of the drainage basins in the more southerly portions of the Sierra Nevada Mountains.

To attempt to introduce the large salmon fly, *Pteronarcys* into streams where they are not now present, would probably prove to be wasted effort by reason of the fact that being winged forms, they can, and probably would, have distributed themselves before now had the



FIG. 33. Mayfly nymph *Iron*. Note gill-plates on side of abdomen and depressed body and legs for living in swift water. Six times natural size.



FIG. 34. Damselfly nymph, *Argia*. Note three gill-plates on end of abdomen. Three times natural size.

necessary environmental conditions that they require as home sites existed therein. Further, every cold-water, unpolluted stream invariably contains many smaller kinds of stonefly nymphs that are equally as good food if not of as large size as *Pteronarcys*.

Mayflies and stoneflies have similar life cycles. The eggs are laid in the water where they hatch into nymphs. When grown they emerge from the water as adults. They have no pupal stage. Mayfly nymphs can always be recognized by the presence of gills on the back of the abdomen (see Fig. 33). No other aquatic insect possesses gills in this position. Stonefly nymphs are easily distinguished by their two tails and tufts of filamentous gills at the bases of the legs. Many possess

very beautiful contrasting black and yellow bands on their dorsal surfaces.

Over 55 per cent of the total foods eaten by these rainbow trout from the Merced River were aquatic in origin and about 45 per cent terrestrial.

In Table 3 below are listed the foods eaten by eight Loch Leven and four rainbow trout from another quite different type of stream. These trout were taken from spring runs tributary to Hot Creek in Mono County. Three springs supply a large volume of water of even temperature the year round. Little run-off and no flood waters ever disturb the stream bed thus offering fairly stable environmental conditions to aquatics. As a result watercress and other aquatic plants have grown up in the runs in enormous abundance.



FIG. 35. Fresh-water shrimp, *Gammarus*. Common at Hot Creek, Mono County. Two times natural size.

Table 3.—Foods Consumed by Eight Loch Leven and Four Rainbow Trout from Hot Creek, Mono County *

Class of food	Number found in 12 stomachs	Per cent of total
Snails and small clams	392	55.60
Shrimp	235	33.33
Caddis-flies	56	7.94
Damselfly nymphs	18	2.55
Miscellaneous	4	.57
Totals	705	

* Fish taken November 15, 1933. Average length, 9.74 inches; maximum, 12.1 in., minimum, 8.4 in.

Here it is seen that snails and small clams ranked first forming 55.6 per cent while shrimp were second forming 33.33 per cent of the total numbers of organisms eaten. Bottom collections from the spring

runs have shown shrimp (Fig. 35) to occur in enormous numbers here, over 1000 being found in an area of one square foot. Snails and clams are likewise very abundant and the trout again prove themselves rank opportunists, eating what they can get, where they can get it. It is interesting to note that only one snail and 150 shrimp were eaten by the four rainbows from Hot Creek, this species apparently preferring shrimp to snails and clams. With the Loch Levens the reverse was true, the latter fish showing decided preference for snails and clams rather than shrimp. The shells of the snails and clams apparently pass through the digestive tracts of the fish without harmful effects.

Of the 56 caddis-flies eaten, only four were taken as adults, 52 of them being aquatic larvae and pupae. Damsel fly nymphs (Fig. 34) which formed 2.5 per cent of their diet, are usually absent from the swifter mountain streams, preferring rather the weedy margins of quiet or slowly flowing waters. Their life cycle is similar to that of the mayflies and stoneflies. They can always be recognized by three long slender plate-like gills on the tip of the abdomen.

In the case of the Hot Creek rainbows here reported on, 99 per cent of their foods were aquatic in origin, just five items being terrestrial in origin.

In summary it is to be noted that the dominant foods eaten by trout from the three streams reported on above, were mostly small in size, except for the shrimps, snails, and clams, and large numbers of each were consumed. Also, that the water supplied by far the majority of food, land forms being comparatively scarce, except for leaf hoppers found in the rainbows from the Merced River. It probably takes about as much effort for a trout to secure a large caddis-fly larva as a small leaf hopper, and when over 100 leaf hoppers or fly larvae are found in a single stomach, it is evident that that fish had been very busy just previous to his demise. It is generally conceded that small foods are eaten by small trout and though the average length of the three lots of fish reported on here was only slightly more than six inches, I have opened many trout up to fifteen and eighteen inches in length that contained only such foods as were found in the stomachs of these smaller fish. Larger fish will eat larger forms such as crayfish, minnows, fingerling trout, etc., if they can get them. In many streams, however, large food organisms are lacking and the fish are mainly dependent upon such everyday underwater staples as caddis-flies, mayflies, true flies and shrimp. Last opening date on the Truckee River the 8- to 12-inch trout I caught were packed with just such small underwater forms. One good-sized caddis larva will equal many small mayfly nymphs in body weight. The latter forms make up in numbers what they lack in size in most swift-water streams. Caddis-fly larvae and other large foods are scarce in many streams which makes it necessary for the fish in such streams to eat the smaller foods or go hungry. The above stomach examinations show that they do just this, eating hundreds of small forms in lieu of a lesser number of large foods.

In conclusion, the data presents a brief review of the food of a few trout from three streams. Due to lack of space, no attempt has been made to give any data on stomach examinations of trout from

lakes where their feeding habits are markedly different, or to correlate actual abundance of foods in streams with actual consumption by trout. We are doing this as a part of the work of the California Trout Investigations, the data obtained to be applied toward the development of a scientific stocking policy. The real basis of all economic progress is a detailed knowledge of life histories and habits. Applied to the conservation of trout, the more facts that can be discovered concerning their life histories and habits, the better fitted we shall become to develop intelligent methods of stream management.

STREAM AND BAY POLLUTION STUDIES

By PAUL A. SHAW

INTRODUCTION

In order to deal intelligently with the important problem of maintaining California waters free from detrimental pollution, it is essential to have a clear picture of present conditions, based on accurate data collected in all areas affected. Such a picture would be valuable in formulating a general policy relative to pollution control, and in dealing justly with individual cases. The purpose of the present outline is to indicate the need of certain studies and the general program of activity that will be conducted relative to pollution.

ORGANIC WASTES

Wastes containing oxidizable organic matter include discharges from dairies, tanneries, fibre board and paper plants, canneries, wineries, domestic sewage, slaughter houses, etc. While the relation of this important class of wastes to fish life has been the subject of extensive investigation in various eastern States, it has been given but slight attention in California.

The most dangerous feature of organic wastes lies in their ability to consume large quantities of dissolved oxygen. This process is relatively slow and the detrimental effect on fish life may pass unobserved, due to the fact that fish will avoid the area and fatalities occur only when high temperatures and bacterial activity result in a rapid depletion of oxygen. Thus, while heavy fatalities may be rare, the average condition of dissolved gases, bottom environment and aquatic life may be altered sufficiently to make the area undesirable for fish. With an increasing density of industries and municipalities discharging organic wastes, important water areas may become unsuitable for fish, reducing the normal incoming runs as well as causing fish within the area to seek a more suitable environment.

The ratio between the oxygen available from the diluting water and the oxygen demand of the waste is particularly valuable as an indicator of the intensity of pollution. When this factor is sufficiently high, natural purification will progress without appreciable oxygen depletion and beneficial nutrient material is furnished for aquatic life. In such instances, the streams and bays should probably be recognized as a legitimate means of disposal. However, where this factor is low, a detailed study of the intensity and extent of pollution may be required, while in certain cases immediate steps to abate the condition may be indicated.

The program for study of pollution from oxidizable organic wastes will include the following:

1. Inspect and list industries according to watershed, obtaining data on the quantity and kind of product, character of discharge, treatment if any, and point of disposal.
2. Obtain corresponding data on high and low stage stream or tidal dilution.

3. Correlate 1 and 2 with published or experimental data to estimate the ratio between oxygen available and the oxygen demand.

4. Conduct special studies to determine the dissolved oxygen and oxygen demand, preferably at times of low water and high temperature, in those areas where the above ratio is low.

5. Cooperate with industries to work out modified methods of disposal in areas definitely polluted, resorting to legal action only when absolutely necessary.

In view of the many California industries discharging wastes of an organic nature, the value of the above program in maintaining California waters reasonably free from pollution should be obvious. It will serve specifically as a basis for:

1. Immediate action in polluted areas.
2. Increased watchfulness in areas of potential pollution.
3. Evaluating and dealing fairly with reported complaints of pollution.
4. Showing the trend of pollution if the study is repeated in later years.
5. Progressive modifications in the pollution code.

OIL POLLUTION

In the past, the most troublesome source of pollution in California waters has been from oil. Control of this type of pollution has been particularly emphasized and as a result marked progress has been made in the control of oil waste. However, continued watchfulness is essential and inspections at wharves, shipyards, refineries, sewer outfalls, etc., will be conducted at frequent intervals.

OTHER POLLUTION WORK

The following items will be given attention in addition to the general program on organic wastes and oil pollution:

1. Pollution from hydraulic mining, particularly in the Klamath and Trinity District.
2. Pollution from sawdust, etc., in lumber mill areas.
3. Pollution from plants discharging toxic chemicals.
4. Study of current literature on pollution control.
5. Study possibility of special code to apply to fish hatchery water supplies.
6. Investigate specific complaints.
7. Keep the importance of clean streams before the public through: published articles; local newspaper accounts of control activities; personal contacts; and through cooperation with other organizations interested in abating, or having jurisdiction in regard to pollution.

CONCLUSION

It is to be hoped that conditions which have caused numerous complaints, such as exist in the Eel and Klamath river districts and others which may or may not have been brought to the attention of the Division of Fish and Game, will be cleared up satisfactorily as this study progresses. The task is not a simple one, and the writer will appreciate receiving all data on which game wardens, sportsmen and others have definite information.

THE LAKE ALMANOR HATCHERY

By J. H. VOGT

The new Lake Almanor Hatchery, situated on Clear Creek, was located at this point after many unsuccessful attempts to construct a hatchery in this district where fish cultural operations could be properly conducted. This hatchery was sufficiently completed January 20th of the present year to permit placing eggs in the troughs and the hatchery was in operation a few days following this date. All indications point to the approach of a satisfactory solution of our fish cultural problems in the district with the completion of the new hatchery.



FIG. 36. . First Lake Almanor Hatchery located near Big Meadows Dam. Photographed in 1917.

The Fish and Game Commission, realizing the importance of the fishing that would be developed by the construction for power and irrigation purposes by the Great Western Power Company in the reservoir known as Lake Almanor, decided to begin fish cultural operations in that district in the spring of 1916. So many unforeseen difficulties presented themselves before a satisfactory hatchery site could be procured in this area that a brief history of operations in the district is deemed advisable as a matter of record.

The work during 1916 was conducted in a crude way and with very little equipment. The plans were to prove the value of the district for collecting rainbow trout eggs before beginning extensive developments. Operations were carried on below Big Meadows Dam where over 1,750,000 rainbow trout eggs were collected. Investigations made during the late spring and summer indicated that additional developments would be justified on the North Fork of the Feather River near

Domingo Springs and on Hamilton Branch, both of which are tributary to Lake Almanor. During the fall of this year, a small hatchery was constructed near Big Meadows Dam (see Fig. 36). Racks were installed below the dam to trap fish, rack and trap were constructed in Rice Creek a short distance below a falls in the stream, and an experimental hatchery was built near Domingo Springs.

Operations were conducted for a few years at Domingo Springs without satisfactory results when the hatchery was moved to its present location near the egg collection station on Rice Creek. This hatchery has since been operated with excellent success.

The water supply at the hatchery located near Big Meadows Dam proved to be unsatisfactory for fish cultural purposes, so hatching operations were transferred to a site on Clear Creek, near Westwood. After conducting operations in this small hatchery for a number of years it became evident that the hatchery equipment was inadequate to properly supply the district tributary to Lake Almanor and the adjacent territory in Plumas and Lassen counties. Plans were then made for the construction of a larger hatchery, but its construction was delayed for some years pending selection of a suitable site.

The Division was unable to purchase or lease a site on Clear Creek, where operations were being conducted in the small hatchery, so it was finally determined to build a new and larger hatchery on Benner Creek near Chester, where the water supply originated from this creek. A new hatchery containing ninety-six troughs and other necessary buildings were constructed here in the fall of 1930 by the Division of Architecture of the Department of Public Works. Operations on Clear Creek were suspended and all buildings and equipment belonging to the Division there were moved to the new hatchery.

Construction work on the new hatchery was completed in January, 1931, and it was immediately prepared for fish cultural operations. Eggs were transferred from Clear Creek during the early part of February. However, this site did not prove favorable. Difficulties in operations were encountered immediately after placing eggs in the hatchery. The water supply line, troughs and tanks froze solid, making it necessary to return the eggs to the Clear Creek site. After repeated attempts to overcome this defect it was decided to hold the Loch Leven and eastern brook trout at Clear Creek until later in the season when they were placed in the hatchery at Benner Creek.

Rainbow egg collections were conducted at the tributary egg collection stations and over 5,000,000 rainbow eggs were eyed in the hatchery during June. The water supply, however, began to rise in temperature and the quantity of water became insufficient to care for the eggs and fish on hand. This condition continued until it was necessary to plant all fish during the month of July.

A well over fifty feet deep was dug near the hatchery during 1931 with the view of developing a supply of water to care for the hatchery during the cold winter months. This effort failed to develop enough water to operate a sufficient number of troughs for winter service. The following winter the supply from Benner Creek again froze and it was once more necessary to discontinue operations which necessitated hatching the quota of Loch Leven and eastern brook trout for the district in other hatcheries.



FIG. 37. New Lake Almanor Hatchery. Photo by Wm. Berrian, December, 1933.



FIG. 38. Interior view of new Lake Almanor Hatchery. Photo by Wm. Berrian, January, 1934.

Operations during the late spring of 1932 developed conditions similar to the spring of 1931. Insufficient water and its high temperature made it necessary to move a large number of fish to tanks and ponds temporarily constructed on Last Chance Creek, and the balance were distributed to nearby waters as rapidly as possible.

The efforts made to operate the hatchery located on Benner Creek fully demonstrated that successful fish cultural operations could not be carried on there. Extensive investigations failed to indicate that a satisfactory water supply could be developed, so as a last resort, investigations were made of other possible sites.

After considering all the advantages and disadvantages of different sites, it was determined to locate on or near Clear Creek, using water from Clear Creek, a spring fed stream, for supplying water to the hatchery. An agreement was entered into with the Red River Lumber Company covering a twenty-year lease of a site and water supply. Plans for moving the buildings from the Benner Creek site to Clear Creek were made and work of razing the buildings and reconstructing them at the new site commenced in August, 1933, under the direction of the Division of Architecture. The new hatchery building was enlarged, making room to hold ten tanks and to provide space for a food preparing room. Additional quarters will be provided for the employees and ample garage and storage space allowed. All buildings are set on concrete foundations and it is believed the new construction will last for many years (see Figs. 37 and 38).

The Division of Architecture was unable to complete the new structures within the estimates and the money available, so the project is being finished by labor furnished by the C.W.A. and is under the supervision of Ernest Varnum of the Bureau of Fish Culture.

The district adjacent to the Lake Almanor Hatchery has gradually developed into one of the most important trout fishing areas in the State. Every year an increasing number of sportsmen visit the vicinity for vacation purposes. This increased fishing makes it necessary to increase the output of the hatcheries.

During the years of operations at the small hatcheries at Domingo Springs and Clear Creek, several rainbow trout egg collection stations have been established on the streams tributary to Lake Almanor, and these at the present time constitute one of the most important sources of supply of rainbow trout eggs for our State hatcheries. With the completion and increased output of the new Lake Almanor Hatchery available for the 1934 season, the Division believes that satisfactory fishing conditions can be maintained in the district for many years.

CHANGES IN SARDINE FISHING GEAR IN THE MONTEREY REGION, WITH A NOTE ON EXPANSION OF FISHING GROUNDS*

By J. B. PHILLIPS

NUMBER OF BOATS

The 1933-34 sardine season at Monterey found a greater number of purse seine boats fishing out of this port than any previous season. About 53 purse seine boats fished consistently throughout the greater portion of the season. The total number of purse seine boats that delivered at this port was 61. The number of launch and lighter combinations showed a decrease from previous seasons. About 15 launch



FIG. 39. Sardine boats anchored off some of the Monterey processing plants, unloading or waiting to unload by means of suction pumps. Photo by J. B. Phillips, September, 1933.

and lighter combinations fished rather steadily throughout most of the season, whereas the total number that fished was 23. Several launch and lighter captains chartered purse seine boats during the course of the season. In all, 84 different boats made deliveries in the 1933-34 season. Of these, 68 may be considered to have fished consistently throughout most of the season.

CHARTERED BOATS

A number of the purse seine boats (about 17 of the total number that fished) were chartered by the local owners or crews of launch and

* Contribution No. 135 from the California State Fisheries Laboratory, February, 1934.

lighter combinations. Most of the chartered boats were from Washington waters, the balance from southern California waters. Ordinarily, the original captain and engineer accompanied the chartered boat, the balance of the crew being made up by the charterer. (The crew usually consists of 10 men and the captain.) The charterer usually furnished the net. However, sometimes only the engineer accompanied the chartered boat but occasionally several of the original crew went along with the captain.

PURSE SEINES AND RING NETS

All deliveries of sardines to processing plants at Monterey were made by boats using purse nets, except in one case at the beginning of the season when a small delivery was made to one of the plants by a market crew that used a lampara net. The purse nets are of the purse seine type used largely by the purse seine boats, and of the ring net type that the launch and lighter combination crews adopted a few seasons ago in place of the lampara net formerly used.

During the current season, only two of the purse seine boats used a ring net instead of the purse seine. These were two of the smallest purse seine boats that can not be readily adapted to the use of the heavier purse seine. Since the ring net was adopted in a wholesale manner by the launch and lighter combinations and by many of the purse seine boats at Monterey in the 1929-30 season, it has come to resemble the purse seine to a very great degree, especially when used on the purse seine boats. Now that tanned purse seines are gaining favor with the purse seine crews at Monterey in place of tarred purse seines, about the only remaining difference between the purse seine and the ring net is in the rounded or tapered ends of the latter, the cork and lead lines being joined to form a single pull rope in the latter. In the purse seine the ends are square, the cork line and the lead line extending parallel beyond the ends of the net to form separate pull ropes. Ordinarily, the ring net is also constructed of lighter webbing.

Ring nets have been losing favor steadily with the crews of the purse seine boats since the 1930-31 season, when almost 50 per cent of these crews were using the ring net. Fishermen have found that the lower initial cost of this net does not offset the constant care and repair required because of the lighter construction.

TANNED VS. TARRED PURSE SEINES

Purse seine boats at Monterey are finding that tanned purse seines are not only cheaper to operate than the conventional tarred purse seine but are also easier to handle and thereby speed up hauling operations. The only objection is that the tanned purse seine requires a periodic tanning treatment so as to lengthen its lasting qualities. During intensive fishing the tanning treatment should be performed at least once a month. The logical time for this is during the few days' lull in fishing activities at full moon period, when hard-working crews like to take a well-earned rest on shore. Nevertheless, the double life of the tanned net over the tarred net and the easier operation and the speeding up of hauling operations are becoming the deciding factors.

A few crews experimented with tanned purse seines last season, and this season about one-quarter of the fleet used the tanned seines,

either wholly or partially. In some cases, tarred seines are being replaced with tanned webbing in place of tarred webbing, and in some instances a whole net has been substituted for the tarred net when the latter has worn out. Although it is evident at this time that the tanned purse seine is gaining favor, its universal adoption in succeeding seasons will depend upon facilities for tanning and drying these large nets. Also, whether all crews believe that the added life and speeding up of hauling operations offsets the periodic treatment that must be given a tanned net. The tanning of a purse seine is simplified by removing the bulky cork line and by splitting a large net into two sections.

Near the end of the 1933-34 season, the crew of the purse seine boat *Ranger* of Monterey had two large wooden tanks constructed aboard a floating barge to facilitate treatment of tanned purse seines during future seasons. The original purpose in building this tank was to treat nets with a minimum amount of trouble after the crew had encountered anchovies instead of sardines. A school of anchovies makes the same characteristic luminescence at night that a school of sardines does. The capture of anchovies in sardine nets is annoying because the anchovies often times gill in large numbers necessitating hand-picking, and also it is claimed that the slime from this fish has a detrimental effect upon the net unless it is thoroughly cleansed at the time.

COST OF WEBBING GREATLY INCREASED

Lasting qualities in a net have become a very important factor this season since the price of webbing has increased more than two and one-half times over that for last season. American webbing (9-thread) has increased from 40¢ a pound at the beginning of last season to \$1.07 a pound at the beginning of this season. Japanese webbing has increased a corresponding amount and sells for about 85¢ to 90¢ this season. Most of the crews have found that it is cheaper in the end to buy American rather than Japanese webbing because of the longer lasting quality of the American-made product. There is also less knot slippage in the American webbing.

One or two of the crews have been experimenting with English and Dutch webbing but do not know of their respective lasting qualities at this time.

HOLD CAPACITIES OF SOME PURSE SEINE BOATS INCREASED

During the past two seasons, a few of the purse seine boats have increased their hold capacities for carrying sardines by rearrangement of fuel tanks or forward cross-wall below deck. For example, the hold capacity of the *New Admiral* was increased from 75 to 85 tons, *Pal* from 65 to 83 tons, *Portola* No. 1 (formerly *Agnes S.*) from 75 to 80 tons, *Ohio* No. 3 from 55 to 68 tons.

NETTING OPERATIONS OF PURSE SEINE BOATS SPEEDED UP

The universal adoption by purse seine boat crews of labor and time saving devices, such as the power roller on the turntable, the long bag dip nets for unloading from net into hold, submarine light-scare, and now the gaining popularity of tanned purse seines, and in general

a familiarity with the fishing areas in this region has increased the average efficiency of purse seine boats over that of several seasons ago, when the purse seine boats first seriously threatened the launch and lighter combinations. Several years ago, it took the average purse seine boat fishing in the Monterey region about three hours to lay out, haul in the net, and load a catch of 50 tons of sardines. Now the same can be accomplished in two hours by the average boat using a purse seine.

LIGHTED BUOYS

The lighted buoy has not gained favor as a marker for sardine schools in the Monterey Region. The schools of sardines during the greater part of the season are readily located and judged by the luminescent areas that they produce. However, in the San Francisco region, marker buoys are more popular due to the much reduced or entire absence of luminescence (due to Golden Gate drainage). With reduced or absence of luminescence, schools are located mainly by the splashing that accompanies sardines feeding at the surface of the ocean.

SUCTION PUMP TRIED EXPERIMENTALLY ON FISHING BOAT

A suction pump as an aid to unloading the catch from the net into the hold of the purse seine boat was first experimented with in the Monterey Region during the latter part of the 1931-32 season on the purse seine boat *Pal*. The apparatus did not prove satisfactory and was revised by the inventor. It was tried again during the early part of the 1933-34 season on the purse seine boat *Olympic*, but again found unsatisfactory. The principle of this apparatus is the same as that of the centrifugal suction pumps that are used by all but one of the Monterey sardine plants for unloading boats in deep water.

The long bag dip-net (see Fig. 2), now common equipment of purse seine boats, is a simple, inexpensive, fool-proof means of unloading the catch from the net into the hold of the boat. These large dip nets can hold as much as $2\frac{1}{2}$ tons and will unload as much as 80 tons per hour from net into boat. This long bag dip-net, however, is not used in unloading the boat at the processing plants. The shallow dip-net or "brail" (see Fig. 3) is used alike for this purpose by purse seine boats and launch and lighter combinations. The shallow dip-net or "brail" is emptied in a manner opposite to that used with the long bag dip-net. The former is emptied by allowing the weight of the contents to force open the bottom of the net when the purse chain is slackened. The bottom of the net is kept closed while the net is being dipped full, by pursing the bottom of the net by means of the chain that runs through a series of small rings around the bottom edge of the net. On the other hand, the long bag dip-net is emptied through the same opening by which it is filled. After the long bag has been filled by guiding the mouth or hoop of the dip net into the bunched fish, the hoop is placed perpendicular to the edge of the hold of the boat and the end of the bag hoisted. The hoisting is accomplished when the rope, that is fastened to the end of the bag and which passes through an overhead block at the end of the boom, is reeled in on a revolving drum.

ELECTRICAL SHOCKING DEVICE TRIED EXPERIMENTALLY ON FISHING BOAT

An electrical device which the inventor hopes will be an aid to fishermen in controlling the movements of sardines as the net is being laid around them was given a preliminary trial on the purse seine boat *Olympic* during the latter part of the 1933-34 season. The movements of fish were to be controlled by shocking them by means of elec-



FIG. 40. Long bag dip net such as is used by purse seine boats for unloading catch from net into hold of boat. Note that the end of the bag is closed and fastened to hoisting rope, by means of which the net is emptied. Photo by J. B. Phillips, February, 1932.

trodes spaced at intervals around the net, receiving charges from a large generator on the boat. This apparatus did not prove very successful during the trial period. It is highly improbable that the electrical device could replace the simple but effective submarine light that can be lowered to any depth and flashed intermittently as a scare to keep the fish back in the bag of the net while the bottom is being pursed. A scare that the fish can see, such as the flashing light, is more effective than something which is unseen.

EXPANSION OF FISHING GROUNDS IN THE MONTEREY REGION

Until the season of 1924-25, sardine fishing activities in the Monterey region were conducted in waters adjacent to Monterey. Beginning with the 1924-25 season, the seining area extended gradually northward until in 1928-29 the boats fished as far as Half-moon Bay, a distance of some 70 miles northward of Monterey. With the advent of a large number of purse seine boats into the Monterey sardine fishery in the season of 1929-30, the area fished was extended still farther northward to Point Reyes, a distance of about 115 miles from Monterey. This fishing area remained constant until the 1933-34

season when it was extended southward of Monterey to Pfeiffer's Point, some six miles south of Point Sur and about 28 miles southward of Monterey.

The southern area between Point Sur and Pfeiffer's Point was first fished by a portion of the fleet between January 15 and 19, when schools of sardines became scarce to the northward of Monterey. The area to the southward of Monterey was not fished again until February 11, when a portion of the fleet again fished between Point Sur and Pfeiffer's Point. The catches during the last trip were composed mainly of medium small fish which the processing plants were reluctant to handle, so that operations in the southern area again ceased. Probably about 2000 tons of sardines were taken during fishing operations in the area to the southward of Monterey (Point Sur and Pfeiffer's Point).

Sardine crews in the past have been reluctant to try the coast southward of Monterey because of the rugged nature of the mountainous coast, reports that wicked currents at various points interfered with laying out and hauling nets, and the lack of safe anchorage in case of a sudden blow. Furthermore, landmarks are scarce; for example, there are only two lighthouses to guide a

boat along the 80 miles of coast immediately southward of Monterey, whereas, the 80 miles of coast immediately northward of Monterey has four guiding lighthouses. The crews that have fished the southward area successfully do not relish the northward trip back to port when loaded because the sea is running against them.



FIG. 41. Shallow dip net or "brail" with approximately 500 pounds of sardines about to be emptied into the suction line hopper or "sump" alongside of boat. The weight of the contents will force open the bottom of the net when the purse chain is slackened. Photo by J. B. Phillips, February, 1932.

THE KERN COUNTY ELK REFUGE

By LEWIS A. BURTCH, Agricultural Commissioner, Kern County

With three photographs courtesy of Wharton Huber

The tule, or valley, elk (*Cervus nannodes*) is a species peculiar to California which made its last stand in the southern end of the San Joaquin Valley. They originally roamed in vast abundance throughout the great interior valley and large herds inhabited the marshes and sloughs of Tulare, Buena Vista and Kern lakes and those bordering the San Joaquin and Sacramento rivers. The survivors of these bands inhabited the foothills above Buena Vista Lake and Button-



FIG. 42. Bull tule elk along slough in Kern County Elk Refuge. June, 1933.

willow and for many years raided the cultivated fields of the Kern County Land Company and of Miller and Lux, who were farming in that area.

Many of these animals were killed by residents for their teeth. This was a common practice at the time the Elks Lodge was first organized in Kern County.

Henry Miller, founder of Miller and Lux, feared that the species would be exterminated and was instrumental in securing legislation,

both State and Federal, making it a felony to kill an elk. Though fewer elk were killed after this law became effective, the herd continued to diminish in numbers. These animals had no regard for fences and were doing considerable damage to the cultivated crops of Miller and Lux and the Kern County Land Company.

A letter written to James Ogden, manager of the Miller and Lux Ranch at Buttonwillow, in 1904, by F. T. Hittett indicates that the elk were given to the government by Mr. Miller. He states in this letter: "I have a very large pasture enclosed for these elk in Sequoia National Park and would like to be able to get these elk there as soon as possible."

C. Hart Merriam, then Chief, United States Bureau of Biological Survey, described an attempt in that same year to drive this elk herd into a corral which had been especially constructed for the purpose (*The Scientific Monthly*, Nov., 1921, pp. 465-475). The plan was to drive the main band from their nightly feeding grounds to the corral, a distance of six and one-half miles. The date had been set for November 12, 1904. About 35 expert riders and cattle ropers had volunteered, among them our State Senator, James I. Wagy, who did such splendid work in securing the refuge which has recently been built. The drive was in charge of Superintendent of the Ranch James Ogden, who reported that the riders were out long before daylight in order to get behind the elk, between them and the foothills, before daylight. Members of the Biological Survey went to the corral with cameras, expecting to photograph the incoming herd. While waiting they reported that a cloud of dust was seen moving steadily westward at some distance. From a water tank tower, one spectator stated that he could see the elk in front of the moving dust, but suddenly the dust disappeared and it was more than an hour before a rider finally arrived with the depressing news that the elk had broken and scattered to the hills and could not be turned. They had turned and charged the riders, broken through the line and escaped to the hills. A few had been pursued, roped and hog-tied and a horseman had been sent to the ranch for wagons in which to bring them in.

After a long wait, the first wagon arrived at the corral bearing three elk, an old bull, a two-year old male and a calf which was already dead. All had been injured in the roping and fighting before they were thrown and tied and the two survivors were nearly paralyzed from lying so long hog-tied. When the bindings were released and the animals freed in the corral they had great difficulty in getting up and standing. It was some time before they recovered the use of their legs. Nevertheless, the old bull, although scarcely able to stand on his feet, charged the men in the corral as soon as his fetters were loosened, driving them over the fence. He then attacked the two-year old bull, driving his brow tines into its side. The younger animal soon began to bleed from his nose and mouth and later died. To prevent further harm, the old bull was again caught up and his antlers were sawed off close to his head.

Shortly after noon, a second wagon, which had been obliged to travel a long distance to pick up the widely scattered hog-tied elk, arrived bearing five animals. Three of these were already dead, only an old cow and a bull calf reaching the corral alive. Thus eight elk were captured, of which four reached the corral alive and four dead.

The skins and skulls of the elk that died during the drive were preserved for the U. S. National Museum and these specimens, when later examined by Dr. Merriam, proved to be a new species which he named *Cervus nannodes* (*Proc. Biol. Soc. Wash.*, vol. 18, 1905, pp. 23-26).

The cow, calf and the wounded young bull were then moved, without great difficulty, from the corral into a cattle car. The utmost difficulty, however, was encountered in attempting to similarly load the old bull. Merriam's account goes into some detail regarding the

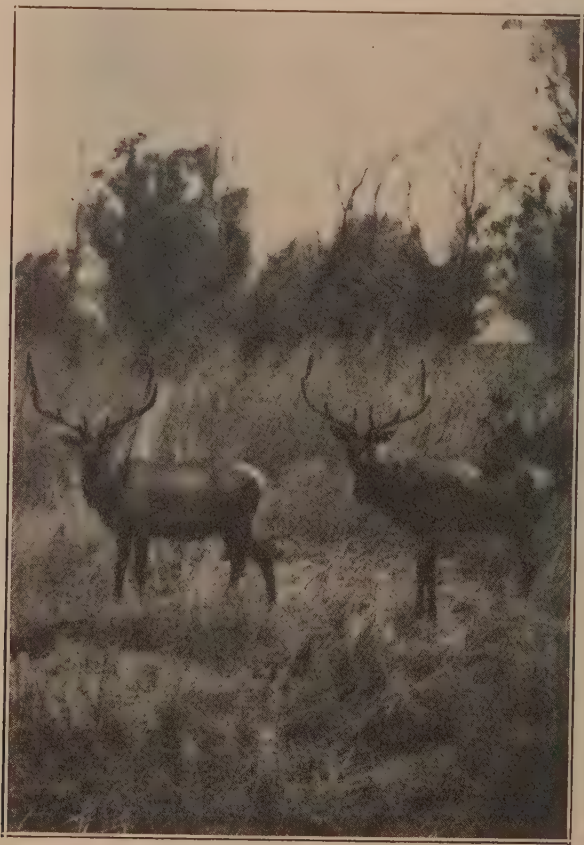


FIG. 43. Two fine bull tule elk photographed on the Kern County Elk Refuge in June, 1933.

terrific battle that this splendid animal, already hornless and much weakened from previous fighting, waged against horses and men before he was finally loaded into the car.

The elk were shipped in the car by rail to Exeter and on arrival there it was found that the young bull and the old cow had died, leaving only the old bull and the calf alive. The latter was here loaded without difficulty into a crate for wagon transportation 35 miles to Sequoia Park. Not so with the old bull, who again put up a tre-

mendous struggle before he was finally dragged with ropes from car to wagon crate. He continued to fight in his crate throughout the trip to the Park, necessitating two stops to reinforce it against the effects of his kicking. The following day, the wagon reached the enclosure that had been prepared for the elk on the Middle Fork of the Kaweah River, where the two survivors were liberated. The old bull had finally reached the limit of his endurance and he could scarcely hobble from his crate. When liberated, he slowly staggered to the river, where he drank, crossed to the far side to lay down on its low bank. Here he was found in the same spot the next day—dead. Thus the only animal to survive the original transplanting efforts was the solitary bull calf.

In the following year, different methods were employed which proved much more successful. Instead of attempting to drive the elk into a corral they were chased and roped by vaqueros. On October 15, 1905, 28 elk were thus captured near Buttonwillow. Three of these died before shipment and of the 25 shipped, 20 reached Sequoia Park alive, where they formed the nucleus of what was then thought to be a promising new herd.

There were no more attempts to move elk from the Buttonwillow herd until 1914 when it had increased considerably and the animals were doing much damage. Different methods were used this time; a large corral a quarter of a mile long was built in an alfalfa field where the elk had been coming to feed nightly. Here 150 animals were captured the night of October 11, 1914, but the next day, 90 fought their way out. Three days later, 25 more were captured and during the month 54 were distributed to seven localities in the State (Evermann, CALIFORNIA FISH AND GAME, vol. 1, pp. 85-96).

In 1915, the same corral was used when 92 more elk were distributed to 14 additional places (Evermann, CALIFORNIA FISH AND GAME, vol. 2, pp. 70-77). Dr. Evermann estimated that there still remained in Kern County between 350 and 400 animals. In most instances, the animals did not do well in their new localities so no further attempts were made to move elk from the Buttonwillow herd.

The elk continued to raid agricultural crops in Kern County but no complaints were heard regarding their depredations until Miller and Lux subdivided their large holdings and sold many pieces of property to small ranch operators comprising 40, 80 and 160-acre tracts. These farmers complained considerably of damage caused by the animals but it was not until 1929 when their demands became insistent that the agricultural commissioner's office in Kern County was petitioned by the growers for relief. Recitations of damage which had cost some growers their entire year's work were made, some of them stating that if something were not done it would be necessary for them to abandon their places.

The agricultural commissioner took the matter up with the Fish and Game Commission and demanded some action from them. A plan was proposed by the Commission to remove the entire herd from Kern County to public parks in other parts of the State, Los Angeles County already having made a request for this band of elk. When this was announced publicly a storm of protest was made by the Elks lodge, the Fish and Game Protective Association of Kern County, and many

individuals who were interested in the preservation of native species and who were not desirous of seeing the last remaining band of a species of animal native to this county exterminated within its borders. Many editorials and newspaper articles were written protesting against the removal or destruction of this herd of animals. Articles headed in large type read, "Remember the Fate of the Bison." Not wishing to incur the enmity of so large a representative group of the people as was making these protests, other means of solving this agricultural problem were considered. Among them was the suggestion that Kern County should purchase a tract of land in the vicinity of Elk Hills, where this band had taken up their last stand, to be given to the State for an elk refuge. This proposal was made to the Board of Supervisors



FIG. 44. A new arrival at the Kern County Elk Refuge. June, 1933.

at a meeting in January, 1930, by a group of citizens representing the Elks lodges of Kern County, the Bakersfield Civic Commercial Association, the Fish and Game Protective Association, the American Legion and others. The agricultural commissioner and members of the county farm bureau were present and demanded that some action be taken to relieve the damage to farmers whether it be the purchase of a refuge, the destruction of the herd or its removal from Kern County.

The Board of Supervisors appointed a committee at this meeting to investigate the cost of sufficient land for a refuge and to recommend to the board the amount of money that Kern County should spend on this problem. This committee represented most of the civic organizations of the county and made a very careful and thorough investiga-

tion of the matter, making a tour of the farms in the vicinity and noting the losses suffered by the farmers involved. The investigation showed a cost of approximately \$100,000 to purchase and fence 1000 acres of land.

The committee felt that Kern County should not stand the entire cost of this enterprise but that the State of California and the Fish and Game Commission should participate equally with Kern County. Their recommendations to the board were that an elk refuge should be established and that the county of Kern should contribute not more than \$35,000 for this purpose.

Following this report, the Fish and Game Commission and the elk committee attempted to get the State Park Board to assist in the purchase of this refuge. The Fish and Game Commission had already pledged \$35,000 as the maximum amount which could be supplied by the Division of Fish and Game. It was therefore necessary to get the State of California to participate to the extent of the other one-third of the expense. Considerable work was done by the committee in an effort to get the State Park Board to take over this project. After spending much effort and time in this regard, it was the opinion of the committee that the State Legislature should be requested to make an appropriation for this work.

In the meantime, complaints were coming in from the farmers and considerable damage was taking place.

Miller and Lux agreed to furnish a piece of ground near where the refuge would likely be established and furnish fencing for it if the Fish and Game Commission would fence it and corral the elk pending final decision on the refuge. Authorization was received in September, 1930, from the Fish and Game Commission to proceed with this program.

After the fence was erected on this temporary refuge a big elk drive was put on by the members of the Division of Fish and Game and the interested ranchers. The result of this drive was very similar to that of the first drive recorded in 1904. When the elk neared the corral, they broke and ran toward the horsemen, past automobiles, dodging and jumping everything in their way and scattered like a band of quail to the mesquite brush. Attempts were made to follow them and try to drive them but they were so wild by this time that there was no chance to get near them. Finally, a lone rider with a number of dogs succeeded in gathering up a small band and driving them into the refuge. This man was an experienced cowhand who knew how to handle wild cattle, so he was employed to attempt the corralling of the elk herd. He was successful in getting about 75 head into this enclosure but the balance of them had taken to the hills where they defied all further efforts to approach them.

This somewhat alleviated the trouble for the time being, but in a short while those animals remaining outside the corral were back in the cultivated fields again. They were chased out of the fields with dogs and shotguns, in spite of which they returned to them at night to feed. At the request of the farmers in that district, the Fish and Game Commission put on a night patrol to ride between the hills and the cultivated fields. This patrol continued until after the fall harvest of crops was completed.

The San Joaquin Valley Elks Association interested themselves in the refuge project and through the efforts of Frank H. Pratt, District Deputy Grand Exalted Ruler, a bill was introduced into the Legislature by Assemblyman Jewett, Hanford, Kings County, on January 22, 1931. This measure, known as Assembly Bill No. 973, asked for an appropriation of \$50,000 for the creation of a game refuge for tule elk in Kern County. The Elk Conservation Committee of the California Elks Association assisted greatly in getting this bill through the Legislature and in seeing that the elk refuge was completed. The bill was referred to the Fish and Game Committee and when first considered by this committee, it was rejected.

Following this, a long battle, headed by the committee from the Elks Lodge was waged in an attempt to get this measure out of committee. The bill was amended on April 24, 1931, reducing the amount of the appropriation from \$50,000 to \$35,000. Governor Rolph was contacted and he agreed to sign the bill if it was passed by the Legislature.

A group from the Elks lodges of the San Joaquin Valley and other interested organizations appeared before the Fish and Game Committee asking for consideration of this bill. They received a very cool reception by this committee and were given but little opportunity to express themselves on its merits. Members of the committee referred to the animals as "mangy critters" and very quickly turned the bill down and dismissed the delegation that went to Sacramento.

We were quite discouraged after this reception and felt that it would be necessary to seek other means of handling the problem. Senator Wagy, who had been working with us constantly on this problem, introduced a bill into the Senate on April 23, 1931, known as Senate Bill No. 951, entitled "An act to provide for reimbursement of persons suffering loss by reasons of the act of tule elk during the closed season." Senator Wagy agreed to withdraw this bill provided the committee would pass Assembly Bill No. 973, which called for the appropriation to take care of the problem. After the above-mentioned group once more went to Sacramento where they had another session with the Assembly Committee on Fish and Game, the bill was finally passed out of committee with the recommendation "do pass." It experienced no difficulty then in passing both the Assembly and Senate and in due time it was signed by the Governor.

Considerable discussion followed the signing of the bill as to which division of the State government should purchase the land. It was finally determined that the State Park Commission should do so and on March 15, 1932, this Division purchased a tract of approximately 1000 acres near the original site east of Tupman, Kern County. The Division of Fish and Game, which is charged with the administration of the refuge, prepared plans for enclosing the area with a seven-foot fence of steel construction. Contract for its erection was let by the Department of Public Works on May 1, 1932, and was completed August 29, 1932. All construction costs were borne by the Division of Fish and Game out of the Fish and Game Preservation Fund.

The elk which were held in the temporary refuge were then transferred to the new enclosure. Members of the Division of Fish and Game then commenced gathering up those animals remaining on the

outside and after many months of hard work, the last was finally enclosed in the refuge. About 140 elk comprised the herd thus established in the refuge.

Administration of the Kern County Elk Refuge is in the hands of the Bureau of Patrol of the Division of Fish and Game. Captain O. P. Brownlow of that unit is in charge and Game Warden Lester Arnold, Bakersfield, is handling its direct supervision. James Culp, Tupman, is guardian and caretaker of the refuge.

The final establishment of this refuge was a source of considerable gratification to the members of the committees who worked so long and so hard for its accomplishment.—*January 12, 1934.*

PORCUPINE CONTROL ON FORESTS OF CALIFORNIA *

By JOSEPH KEYES, Leader, Rodent Control,
Bureau of Biological Survey

For years many sportsmen, hunters and lovers of outdoor stories believed that the porcupine was protected by law. Even today, when statements are made that the Federal Government is actually engaged in the control of porcupines, many comments are heard that would indicate that there are still some who believe these animals to be protected. The fact is, however, that these rodents are not protected in the United States, and, moreover, that two Eastern States have been paying bounties on them for several years.

Losses occasioned by the attacks of porcupines on our national forests have been recognized for several years, and it has been reported in the Southwest that the damage caused by these animals exceeds that resulting from fires. The peculiar type of attack wherein the tree may be completely girdled, especially near the top, may be seen on many areas of the Modoc, Lassen, and Plumas National Forests in California—especially along the eastern slopes. Damage is also apparent on the Tahoe, Eldorado, and Mono Forests.

Porcupines consume succulent plants of many species, and the buds, leaves, inner bark, and cambium of numerous kinds of trees. In general, during summer they feed on juicy ground vegetation. Their fall and winter diet consists largely of bark and leaves of coniferous trees, especially the western yellow pine and several species of juniper.

During the late summer, fall, and winter months, porcupines, in their efforts to get at the inner layer of bark, often partly or completely girdle the main leaders, or boles, of the trees. Many of the small seedlings are completely consumed, while larger ones frequently suffer injuries serious enough to cause their death, but more often this injury results in a weakened bushy-topped or spike-top tree that is useless for commercial purposes. Deep snow may hold these animals to individual trees for periods of one to three months, in which time the tree may be completely ruined.

Fortunately, the rate of reproduction of porcupines is not rapid. They breed but once a year and produce one young (rarely two), born fully quilled. Many attain the weight of 30 pounds and live to a ripe old age. The quills are white, with dark tips, sharp, and finely barbed at the tip, and are used as a means of defense, the greatest damage being inflicted by the porcupine striking an object with its powerful tail. The quills are not thrown. Many domestic and wild animals have

* This paper is published to acquaint the readers of CALIFORNIA FISH AND GAME with the reasons for and methods of Federal porcupine control work in California. The Division has, as yet, taken no definite stand regarding this work, but is watching its results closely, especially as regards the incidental poisoning of harmless or beneficial species of animal life. No evidence of the destruction of such species incident to this campaign has been procured to date.—*Ed.*

been tortured by these quills working into their muscles, and when they lodge in the mouth of an animal, death often results.

Control operations as now conducted on the forests of the north-

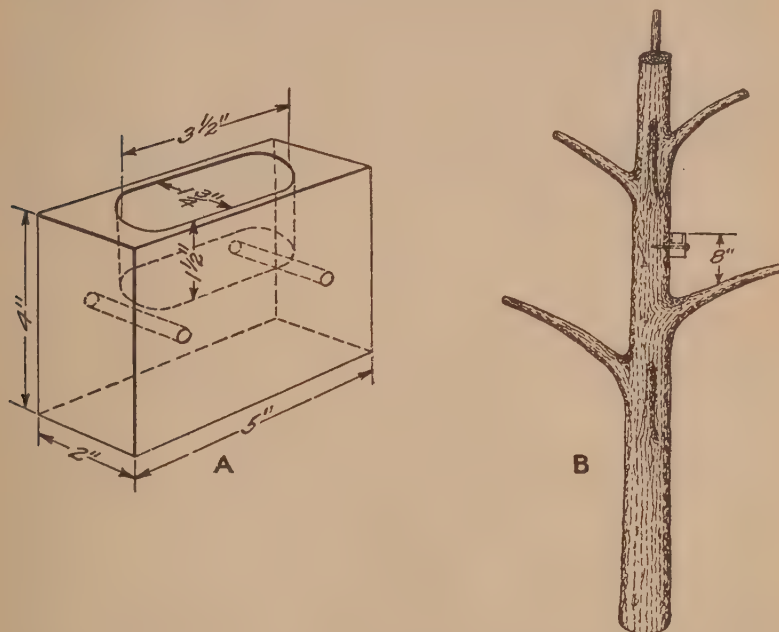


FIG. 45. A. Diagram for preparing a wooden cup for use in exposing poisoned salt for porcupines; B. Method of attaching poison block to pine tree.

eastern section of the State involve methods that have been worked out during the past several years. Salt, of which the animals are very fond, is treated with strychnine and exposed in small wooden blocks five inches long cut from two-by-four-inch lumber. Holes are bored into each block and filled with about three tablespoons of the strychnine-treated salt to which a small amount of dextrose has been added to make it firm.

These blocks are nailed to trees frequented by porcupines, and are securely held in place by 30-penny nails above a limb on which a porcupine may rest while eating the salt (Fig. 45). Such trees are clearly marked with a yellow-tin poison sign (Fig. 46). This tree-blocking method is supplemented by den poisoning, in which the poisoned

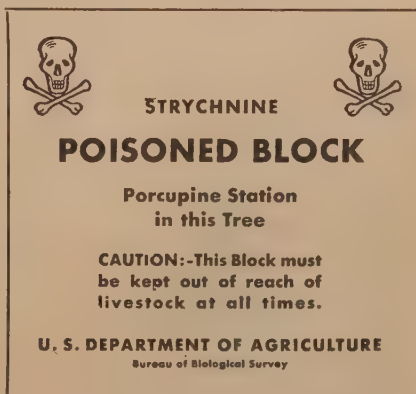


FIG. 46. Facsimile of tin poison sign placed on each tree blocked. Black letters on a yellow background. Actual size 3 1/2 inches square.

salt is placed far back in the rock dens under lava, where porcupines occasionally concentrate, especially during the breeding season, stormy weather, or during the extreme heat of summer. Members of crews carrying on these operations are also provided with a twenty-two rifle or pistol, supplied with ammunition, and instructed to shoot such porcupines as they may locate. Hunters and sportsmen can render their forests a valuable protection in localities where these animals are destructively abundant by likewise keeping a lookout for these animals and destroying them when found. Porcupines can generally be located in the daytime, resting high in a pine or juniper, or asleep several feet out on a limb.

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G. D. NORDENHOLT APPOINTED DIRECTOR, DEPARTMENT OF NATURAL RESOURCES

George D. Nordenholt was appointed by Governor Rolph to the Directorship of the Department of Natural Resources on February 5, 1934. Mr. Nordenholt has an enviable career behind him that seems to fit him particularly for his present position.

Born in Illinois in 1884, Mr. Nordenholt spent his youth in that State until he completed two years of study at the University of Chicago. He then went to Colorado where he attended that State's School of Mines for four years and incidentally won all-American recognition for playing fullback on its football team. After graduation from college, Mr. Nordenholt came to Los Angeles in 1908 where he became tunnel foreman on the Los Angeles Aqueduct and broke a world's record in tunnel driving. Since that time he has devoted his energies to mining engineering and petroleum geology, which work has carried him from Alaska to Central America.

While mining and oil have been Mr. Nordenholt's business, fishing and hunting have formed his favorite recreation. He had his first shotgun at the age of ten and has ever since been an enthusiastic hunter. A gun and fishing rod formed important items in the equipment for his wide travels and wherever these led him, he always found wild life and the conditions affecting it of the greatest interest. Mr. Nordenholt has been a successful big game hunter, but he now prefers duck and quail shooting. He shoots a 20-gauge double-barreled gun on waterfowl and a 28-gauge on quail.

Mr. Nordenholt is also an enthusiastic fisherman. He has enjoyed much ocean fishing in southern California in addition to his favorite sport, trout fishing, which he has been so fortunate as to have followed in Alaska, Canada and in many states besides California. The Klamath River is his favorite stream in our State and he is intimately acquainted with conditions on this river. The new Director ties his own flies and confesses that he has one or two variations of his own invention that he likes best. He has taken an active part in matters affecting fish and game for a great many years.

There is no doubt that Mr. Nordenholt's life and activities preeminently fit him for his newly acquired position. The direction of the Department of Natural Resources embraces supervision of the State Divisions of Mines, Oil and Gas, Forestry, State Parks, and Fish and Game. The new Director's business and recreational life, his wide travels and experience, continued interest in the out of doors and fish and game matters seem to assure California sportsmen that their problems will receive sympathetic and understanding attention.

The Department and this Division are also fortunate in being able to retain Mr. D. H. Blood, whom Mr. Nordenholt succeeded as Director, as Deputy Director and Chief Accounting Officer of the Department. Mr. Blood's loyal and friendly help during his three years as Director of the Department will long be remembered by this Division.

NEW ANGLING AND HUNTING LICENSE BUTTONS

The Fish and Game Commission adopted an identification button to accompany the 1934 angling licenses, effective January 1, 1934. The reaction to these buttons was so favorable that the Commission decided to issue similar buttons with the 1934-1935 hunting licenses.

These buttons are manufactured of metal and are one and three-quarter inches in diameter. The face is celluloid covered and varies in color in accordance with the kind of license issued. In addition to stating the type of license, there is printed on the face of the button its classification, whether resident, nonresident, alien, etc., and license number to correspond with the number of the usual paper license. In the back of the button, there is a pocket in which the paper license is to be carried and a heavy brass safety pin for securely fastening the button to the clothing.

The colors of the angling license buttons are as follows: resident citizens and Indians, red; non-residents, light green; aliens, orange; duplicate buttons are blue.

The colors of the hunting license buttons are: resident citizens, dark green; non-residents, purple; aliens, light blue; declarant aliens, yellow; duplicate buttons are pink. A button, dark green in color, similar to that of a resident citizen's is provided for juveniles, with the word "junior" added.

Section 432 of the Fish and Game Code provides for the issuance of duplicate hunting or sporting fishing licenses upon the payment of a fee of 50 cents and furnishing of an affidavit showing the loss or destruction of the license previously issued.

Visible licenses have proved to be satisfactory in several eastern states where they have been employed and leading California sportsmen's organizations have advocated their adoption here for some time. It is hoped that the new buttons will result in a greater sale of angling and hunting licenses and there is no doubt that they will greatly assist the game wardens in checking bearers of licenses.—*O. L. Warner, February 15, 1934.*

NOTES ON THE CALIFORNIA TROUT INVESTIGATIONS

The new experimental weir constructed on Waddell Creek last summer for use in detailed studies of life history and habits of the sea-run steelhead trout has proven very satisfactory to date. This was specially constructed to count downstream as well as upstream migrating fish and while it catches all the latter fish, during periods of high floods only a portion of the former fish can be caught. So far during the present season approximately four hundred silver salmon and two hundred steelhead have been handled at the weir, and the steelhead run is still in progress. For the same period several hundred cottoids and some immature trout were taken while migrating downstream. The new weir is proving to be a great asset in working on problems relating to the conservation of steelhead trout.

Environmental studies made in Sierran streams such as the Merced River in Yosemite Valley have shown that this stream averaged about 103 pounds of food per acre of riffle area in the month of February. Food samples from the same areas in August showed an average of 85 pounds per acre. These are significant figures. They indicate that contrary to the usual belief that foods are scarce in streams in the winter time, there is at least as much food at this season of the year and there may be more than in the summer time. Further investigations will be necessary to verify these findings.

Waddell Creek, a coastal stream near Santa Cruz, was found to average 198 pounds of food per acre of riffle area over all seasons of the year, or more than twice as much as was found in the Merced River. Lagoons of coastal streams are very rich in food. Waddell Creek Lagoon was found to average over 250 pounds per acre of bottom area. In this connection it is interesting to note that while aquatic insects compose the bulk of foods in coastal and Sierran streams, lagoon foods are largely shrimps and isopods. These are organisms which can withstand extreme changes in salinity and other environmental conditions and at the same time find ample food for themselves in such areas.

Plans are rapidly being developed for an intensive stream survey of the better fishing areas in California next summer. Through funds allotted by the Public Works Administration to the United States Bureau of Fisheries it is planned to operate several four-man field parties to carry on intensive biological investigations in both streams and lakes. This work is to be done in cooperation with the Division of Fish and Game and the National Forest Service as an integral part of the program of the California Trout Investigations. The object of the work is to gather such facts on the waters investigated as will assist in the formulation of well-balanced stocking policies. Detailed plans for the work will be published later.

In brief, excellent progress is being made on the problems upon which the staff of these investigations are working, and this is due, in no small part, to the splendid cooperation extended to us by officials of the Division of Fish and Game, sportsmen, wardens, fish hatchery men, and others.—*P. R. Needham, Associate Aquatic Biologist, U. S. Bureau of Fisheries, Stanford University, California, February 16, 1934.*

COMMERCIAL FISHERY NOTES

PACIFIC COAST WHOLESALE FISH DEALERS CONVENTION

On February 5 and 6, 1934, the wholesale fish dealers of the Pacific Coast met in convention at San Francisco. The delegates represented the various dealers' associations of the coast, including:

California Producers and Wholesale Fish Dealers' Association.

California Fish Trades Industry.

Northwest Wholesale Fish Dealers' Association.

Commercial Fisheries Association of Oregon.

North Pacific Oyster Growers' Association.

North Pacific Crab Fishermen Association (represented by proxy).

At the convention the delegates approved a set of articles of association and by-laws for an "association of associations" which is to be known as the Pacific Coast Fisheries Association. A model code of fair trade practices, prepared by R. H. Fiedler, Acting Deputy Administrator for the National Fisheries Code, was presented to the delegates, and with minor changes was adopted as a regional code for all associations on the coast. This, then, except for minor details to take care of purely local conditions, will assure a uniform code for the various groups on the Pacific Coast, each under local management.

A temporary board of directors, subject to the approval of their various associations, was elected and a secretary chosen. Temporary offices of the association will be at 556 Clay Street, San Francisco. Several committees (price, publicity, legislation, credit, trade classification) will be appointed at the first meeting of the board of directors.

The convention was well attended by wholesale dealers from the entire Pacific Coast of the United States. The formation of a Pacific Coast association will bring the dealers into closer contact and their various problems can be discussed and solved with lasting benefit to the trade as a whole. In addition, the convention afforded an opportunity for the dealers from the various localities on the coast to meet each other and become acquainted.

During the meetings several interesting talks were given. Among the speakers were Arthur S. Coffin of the Sardine Institute, Daniel W. Hone, Attorney for the California Producers' and Wholesale Fish Dealers' Association, and Major John L. Farley, Executive Officer of the California Division of Fish and Game. N. B. Scofield, Chief of the Bureau of Commercial Fisheries of the Division, and other members of the Bureau were in attendance at the meetings.—*G. H. Clark, March 1, 1934.*

TWO MACKEREL RECORDS BROKEN

On February 2, 1934, the San Pedro fishing boat, *I. O. Y.*, brought ashore the largest mackerel ever recorded by the California State Fisheries Laboratory. This fish was 21½ inches (545 mm.) in length, measured to the fork of the tail. It was not possible to weigh the fish but its calculated weight was in the neighborhood of 3½ pounds. All the fishermen and cannerymen who saw it pronounced it the largest mackerel they had ever seen. The size of this fish is all the more remarkable when it is realized that the average length of the Pacific

mackerel (*Pneumatophorus diego*) delivered to San Pedro canneries is about 14 inches and their average weight is a trifle over 1 pound. Previous record breakers were no more than 18 inches in length and $2\frac{1}{2}$ pounds in weight. This remarkably large fish was caught in a ring net haul off Huntington Beach in company with 1600 pounds of average sized fish.

The other record to be established was of an entirely different nature. During 1933, California fish canneries packed more mackerel than in any previous year. They produced about 740,000 standard cases; over 8 times the 1932 pack and 145,000 cases more than in 1929, which showed the best previous pack. Although the bulk of the output was produced at San Pedro, the canneries at San Diego and Monterey also put up heavier packs than ever before. The large production resulted from the increased prices of competitive grades of salmon and a growing consumer demand. Most of the canned mackerel was sold in the United States although considerable quantities are still exported, principally to the Philippine Islands and Italy.

Canners are planning a large pack for 1934 and are making ready for the coming season which will swing into full stride during the early summer. In the meantime they are taking what quantities they can get although mackerel are scarce at present as is usual during the period from February through April.—*Richard S. Croker, California State Fisheries Laboratory, February 15, 1934.*

AN UNUSUAL SARDINE

One of the largest sardines ever taken in the San Pedro fishing region was brought to the California State Fisheries Laboratory by Mr. H. J. Langdon, Cannery Inspector, Division of Fish and Game, on February 22, 1934. The fish, taken in local waters the previous night, was 14 inches total length, 300 mm. body length, and weighed 14 ounces. Age determination indicated that it was nine or ten years old. This sardine was exceptionally fat, and anatomical examination showed an entire absence of sex organs. This lack of sex organs probably caused the unusual size and fatness of the fish, since the energy normally expended to mature sex products was devoted to growth in length and weight.—*Frances N. Clark, California State Fisheries Laboratory, February 23, 1934.*

GROUND FISH

In September, 1933, additional work was started on the fishes taken by the paranzella trawlers which operate principally out of San Francisco. This is the largest fresh fish fishery of northern and central California, producing and marketing 12 to 13 million pounds of fish a year. Of this total about 11 million pounds consists of the various species of soles and sand dabs. The rest of the catch is made up of rockfishes, cultus cod, sablefish, hake, rays and sharks. Large numbers of people are dependent upon this supply as a source for their fish needs and it is important that the Division have a more intimate knowledge of the fishery. As a consequence, work was instigated to gather more information on these fish and on the fishery, and the work will continue until the major problems are solved.

In the short period the work has been in progress the Division has, with the full and utmost cooperation of the dealers who own the paranzella boats, adapted and put into operation a ship's log book on these boats. These logs are furnished by the Division and are made out daily by the captains of the boats, the dealer receiving a copy, the boat a copy, and the Division a copy. On the logs are shown the detailed operation of the fishing boats, the number and time of drags, location of grounds, and the catch of various species for the drags and day. Not only are these logs invaluable to the Division for use in statistical and biological work but they are of equal value to the dealers who will be able to operate their equipment more efficiently and economically with the knowledge gained from the log records.

In addition constant observations are being made in the markets and on the boats themselves on the proportion of species in the catch, the sizes of fish taken by the gear, and material is collected which will lead to a knowledge of the life history of the important species in the catch.

The dealers and operators of the paranzella boats have most willingly cooperated in all phases of the work. They realize that it is to their advantage to do anything in their power to conserve the fish upon which the fishery depends and upon which their business is founded.—G. H. Clark, *February 28, 1934.*

THE PISMO CLAM IN 1933

The condition of the population of Pismo clams (*Tivela stultorum*) on Pismo-Oceano Beach is somewhat better than it was a year ago. For many years the clams have been showing every evidence of serious depletion due to excessive digging. However, the economic depression caused a slacking off of digging, and as a consequence the mortality of clams was probably at a minimum in 1933.

As previously reported by Clark (CALIFORNIA FISH AND GAME, vol. 18, no. 2, pp. 170-180, 1932) the spawning seasons of 1929, 1930 and 1931 were very successful and resulted in good sets of young clams. However, the first-year survival of these sets was but 36 per cent, as compared with an average of over 80 per cent prior to 1929. In other words, these three good spawnings were not given much chance to repopulate the beach. Large clams had become so scarce that diggers took even those less than a year old.

Due to the diminution of digging in 1933, the survival of clams of all ages has been good since 1932. More clams of the 1927 and 1928 seasons are on the beach than had been expected. These clams are just attaining legal size (5 inches). The 1929 and 1930 sets are holding out much better than expected, considering the heavy mortality during their first two years on the beach, but for some reason the 1931 set is showing very poorly. Not much can be hoped for from the 1932 set which was too small to be of any importance, but there are indications that its first-year mortality was low.

The 1933 set was fairly good, in fact better than any since 1924 with the exception of the three referred to above. As usual, the set of young clams was poorest in the area closed to digging at the south end of the beach. The young clams were very small when observed in November, probably due to the cold summer and a late spawning.

The average size of the 1933 clams was 15 mm. as compared with 22 mm. for the 1931 clams at a comparable date.

New laws prohibiting digging or the possession of digging tools on the beach at night and prohibiting the possession of digging tools at any time in the closed area are expected to facilitate patrol work on the beach.—Richard S. Croker, *California State Fisheries Laboratory, December 12, 1933.*

THE LIFE HISTORY OF THE BAY SMELT

Three species of the Atherinidae, or silversides, family are taken in California waters. The jack smelt plays the most important role in the commercial fisheries of the entire State. Bay smelt, however, are taken in important numbers in the San Francisco and Monterey regions and small quantities occur in the southern California catches. The grunion, the third of these three silversides, is renowned because of its unusual habit of depositing the eggs at high tide line on the southern California beaches. The life histories of the jack smelt and grunion have been studied previously and published by the California Division of Fish and Game.* Dr. Leonard P. Schultz now contributes the life history of the bay smelt in a recent publication, "The age and growth of *Atherinops affinis oregonia* Jordan and Snyder and of other subspecies of bay smelt along the Pacific coast of the United States."† Schultz's work, which is revised in the following paragraphs, is of special interest because of the problems which have arisen as a result of the size limit placed on smelts by the last California State Legislature.

Three subspecies of bay smelt are recognized as inhabiting the mainland bays of the Pacific coast from Oregon to San Deigo, California. *Atherinops affinis oregonia* ranges from Oregon to Humboldt Bay, California. *A. affinis affinis* is found from San Francisco to Monterey Bay and intergrades with *A. affinis littoralis* from Monterey to Santa Barbara. The latter species occurs in bays as far south as San Deigo.

Schultz's paper covers in greatest detail the life history of *A. a. oregonia* but also comprises studies of the life history of *A. a. littoralis*. Calculations of the age and rate of growth are based on length frequencies and scale readings. Scales proved satisfactory for age determination through the third year for the Oregon bay smelt. For the southern California species, scales were not satisfactory because 15 per cent of the fish failed to form an annulus in the first year and in other instances the scale structures were so indistinct that in only 72 per cent of the total could the annuli be identified.

The approximate average standard length in millimeters at the end of each year for the two species was found to be as follows:

Age -----	I	II	III	IV	V	VI
<i>A. a. oregonia</i>						
Male -----	98	185	215	230	240	255
Female -----	100	190	220	240	260	280
<i>A. a. littoralis</i>						
Both sexes -----	60	100	115	---	---	---

* Clark, Frances N. 1925. The life history of *Leuresthes tenuis*, an atherine fish with tide-controlled spawning habits. Fish Bull., no. 10, 51 pp.

Clark, Frances N. 1929. The life history of the California jack smelt, *Atherinopsis californiensis*. Fish Bull., no. 16, 22 pp.

Thompson, William F., and Thompson, Julia B. 1919. The spawning of the grunion (*Leuresthes tenuis*). Fish Bull., no. 3, 29 pp.

† Univ. Washington, Publ. Biol., vol. 2, no. 3, pp. 45-102, 1933.

The maximum length for the Oregon bay smelt was 299 mm. and the oldest specimens were in their seventh or eighth year. The largest specimen of the southern California subspecies was 169 mm. and the oldest specimen in its seventh or eighth year. The rate of growth of *A. a. littoralis* is much slower than of *A. a. oregonia* and yet the maximum age is probably the same for both subspecies.

About 5 per cent of the Oregon bay smelt reach maturity in their second year and the remainder in their third, but at least two-thirds of *A. a. littoralis* mature in their second year and the remainder in their third. *A. a. oregonia* spawns in Coos Bay, Oregon, in May, June and early July. *A. a. littoralis* spawns in Anaheim Bay and San Diego Bay in April, May and June and possibly as late as July. Little material was available for a study of *A. a. affinis*, but its life history apparently occupies an intermediate position between *A. a. oregonia* and *A. a. littoralis*.

A. a. oregonia migrates during the spring to the upper part of Coos Bay, where spawning takes place. In the late summer this bay smelt occurs only in the lower part of the bay. Between October and February it is not taken in Coos Bay by commercial fishermen, who say these fish have entered the ocean.—*Frances N. Clark, California State Fisheries Laboratory, February 21, 1934.*

NOTES ON THE SARDINE FISHERY

The sardine season which closed at Monterey and northern California on February 15 and which will close at San Pedro and southern California on April 1 will be recorded as the most successful in the history of the industry so far as the size of the catch is concerned. When the figures are all in, the catch for the season, including the floating plants operating outside the 3-mile limit beyond the control of the State, will exceed 350,000 tons. This amount exceeds by more than 25,000 tons the previous greatest season of 1929-1930. Roughly, 125,000 tons of the sardines taken this present season were used for canning, while 225,000 tons were used in reduction plants. The number of cases of sardines packed this season was less than half that of the big season of four years ago. The reason for the greatly increased catch was the liberal granting of reduction permits by the Fish and Game Commission.

Similar permits were granted to sardine plants during the previous season to relieve actual distress among the fishermen and to enable the sardine plants to operate in the face of the great slump in foreign demand for California canned sardines. As the prices for the reduction products, oil and meal, were also very low, the fishermen received only \$4 per ton for their fish. Quite a number of the plants did not open and most of the plants which operated did not exhaust the amount of their permits. The catch was therefore light and the season was an unprofitable one, especially for the fishermen.

The present season opened with much better prospects. There was a better market for canned sardines and the prices for sardine oil and meal had advanced nearly 50 per cent over the previous season. After considerable bickering and a strike of a month on the

part of all sardine fishermen, the price was set at \$7 per ton. All plants in the State operated and two or three new ones started up, so that all told the season has been a very satisfactory one to both the fishermen and the canners.

The increase in the amount of sardines caught this season does not mean that sardines are becoming more abundant. The fact is that the sardines were less abundant this season and the increased catch was made by increasing the fishing effort. Many more and larger boats are now fishing than in the past and the fishermen are working harder and longer with this increased equipment to make their catches. That the increase of the present season's catch over the past season is due to a greater fishing effort is well illustrated by the operations of the two largest of the floating reduction plants operating off the California coast. During the present season the weather conditions were better and the fishermen and the two plants were more experienced but, with a 56 per cent increase in the number of large purse seine boats, they were able to increase their catch but 21 per cent. This means that sardines were not so abundant this season as last. During the present season the average catch per haul of the net was only half that of last season.

This decrease in the sardine supply was expected and predicted at the opening of the present season. The following communication from the State Fisheries Laboratory, dated August 29, 1933, predicting conditions to be expected during this sardine season, was distributed to the members of the sardine industry.

During the past year various members of the laboratory staff have formulated predictions about the 1933-1934 sardine season. As the season is now opening, we wish again to call your attention to the possibilities for the coming season.

In discussing the California sardine fishery, it is necessary to distinguish between the fall and winter fisheries, and our predictions are made on this basis. By fall fishery we mean at Monterey and San Francisco the fishing carried on from August through November, and at San Pedro fishing in November and December. The winter fishery includes December, January and February at San Francisco and Monterey, and January, February and March at San Pedro.

In the 1933-1934 season we expect that fall fish in Monterey Bay will be scarce and large in size; at San Pedro fall fish will probably be fairly abundant and of small size. In all localities the winter fish will be less numerous than in the immediate preceding winters and of unusually large size.

In December, 1932, we pointed out that in the past four years only two relatively abundant year classes have entered the California sardine fishery. These year classes have supplied the major portion of the sardines taken in the fall months during these past four seasons. In the winter months the fishery has been maintained by older fish which at the present time (August, 1933) have largely disappeared from the fishery because of intensive fishing and natural mortality.

On the bases of these facts, in February, 1933, tentative predictions were made for the 1933-1934 sardine season. After the close of the 1932-1933 season and after the spring conditions at San Diego were determined, final predictions for the coming season were forwarded to you in July, 1933.

No abundant group of sardines has entered the fishery since 1930. As the sardine contributes materially to the commercial catch only up to its seventh year, the year classes which entered previous to 1929 no longer play an important role in the fishery. The year classes which entered the fishery in the fall of 1929 and 1930 supplied the bulk of the sardines in the 1932-1933 season and played an important role in the fisheries for the previous three seasons. It is clear that the sardine fishery is and has been largely dependent upon the year classes which entered the fishery in 1929 and 1930. In the coming season, 1933-1934, the industry

will still have to depend on these two groups. It is certain that both groups have been diminishing and will continue to diminish in numbers from now on.

San Francisco and Monterey Fall Fishery

(August to December)

The outlook for the Monterey 1933 fall fishery, therefore, is not promising. Our studies show that no new abundant year class will enter this fishery this season. The fishery will have to rely on the older year classes (groups entering the fishery in 1929 and 1930) which have been the mainstay of the fall fishery throughout California for the past three and four years. These year classes can no longer furnish a large supply of fish to the Monterey fall fishery. Therefore, the Monterey boats will have difficulty in obtaining fish in the Bay and will have to go farther north for their fish. This will lengthen the trips, decrease the total deliveries, and prevent the smaller boats from participating heavily in the fishery. San Francisco will have a fairly abundant supply of large sardines and the boats in that region will experience less difficulty in making catches than will the boats in Monterey Bay.

The bulk of the Monterey fall sardines for 1933 will be of large size, roughly eleven inches in total length. San Francisco sardines will be the same or slightly larger in size.

San Pedro Fall Fishery

(November to December)

The prospects for the San Pedro fishery in the fall of 1933 are more promising. In the spring of 1933 observations made at San Diego indicated a fairly abundant group of quarter-oil sizes. These sardines should enter the San Pedro fishery in the fall of 1933. If this group appears, the San Pedro fall fishery will be supplied by moderately abundant fish of small size (8 to 9 inches, total length). These sizes will comprise the major part of the catch.

If this year class does not enter the San Pedro fishery in the expected magnitude, the fall fishery in this region will experience a scarcity similar to that for Monterey. The fish will be irregular in size, varying from 9 to 11 inches in total length.

The abundant year class, which is expected to enter the San Pedro fishery in the fall of 1933, will have to support the 1933 San Pedro fall fishery and the 1934 Monterey fall fishery; possibly also the 1935 fall fisheries in all localities if no other abundant group enters the fishery. For this reason the fish supplying the 1933 San Pedro fall fishery should be relieved of as much strain as possible. To accomplish this, the industry at San Pedro should be urged to concentrate on the winter fishery (January 15-April 1).

Winter Fishery for All Localities

(January-February-March)

The abundance of the winter fish along the entire coast will presumably be somewhat less than in the 1932-1933 season. This fishery is supplied by older fish than the fall fisheries, and in 1933-1934 will chiefly depend on the year classes which entered in 1929 and 1930. As pointed out above, these year classes have been subjected to heavy fishing in the past three years and they probably will not be able to maintain an abundant winter fishery in 1933-1934. The sizes of sardines in the winter of 1933-1934 will be large, the bulk of the catch exceeding eleven inches in total length.

It may be well to point out at this time that because a high percentage of the winter fish are quite large, at present, and are rapidly passing out of the fishery, also because there have been only two comparatively abundant groups entering the fishery in the past four years (and these two groups, 1929 and 1930, have been intensively fished during this period), that two or three years hence the winter fish will be rather seriously reduced in numbers. Perhaps this reduction will be so great that the fishermen will not be able to supply the cannery demand.

Explanations

"Abundance," as used in the above predictions, means relative numbers of sardines only. When we speak of an abundant supply we refer to more than average, and when we mention "scarcity" we mean less than average. During a season when we predict a scarcity of fish, boats may and probably will experience good fishing for short periods. On the other hand, when we predict abundant fish for a season, there will be time intervals in the season when the boats will have difficulty in locating fish.

Under present conditions of the industry, we are not able to predict the actual tonnage to be expected for a given season. This is due to the fluctuating effort expended by the canneries and the fishermen. In a season when fish are scarce, the fishermen may exert greater effort and the total tonnage caught may equal or exceed a season when fish are abundant. Predictions of total catch can not be made unless an industry is stabilized and exerts the same amount of fishing effort each year.

These predictions were borne out to a remarkable degree of accuracy. The fishery is entering a period of comparative scarcity of fish and it is the prudent thing to take good care of the present supply of sardines. It was due to this warning that the Commission cut down the amount of the reduction permits issued to each plant by 1500 tons under that of last year. Sardine shore plants naturally object to having their reduction activities curtailed while the floating plants, operating offshore outside the State's jurisdiction, can operate without any restrictions.

The sardine industry of California was about the first of the fishery industries to formulate a code of fair competition acceptable to the code committee at Washington, D. C. The object of the N. R. A. is not only to eliminate unfair competition but also to conserve natural resources, and, as members of the sardine industry believed the floating reduction plants are unfair competitors and are a menace to the future supply of sardines on our coast, they sought to include those plants within the scope of the code and thus bring them under the jurisdiction of the State, the same as the shore plants. This was naturally opposed at Washington by the floating reduction plant interests.

The Division of Fish and Game aided the sardine canners in their move to bring these plants under the same State control as the shore plants by submitting a brief by N. B. Scofield for the final Washington hearing on the sardine code pertaining to the effect of floating plants on the sardine conservation program of the Division. This brief was presented and defended at the Washington hearing on January 29 by John L. Farley, Executive Officer of the Division. The code has not as yet been signed (March 5) although, to hurry its acceptance so as to curb the immediate evils of price cutting, it was agreed to let the matter of including the floating plants in the code go over for further investigation and future action on the part of the executive committee of the regional code.

The Bureau of Commercial Fisheries has been of considerable assistance to different fisheries groups which have been formulating codes. From the records of the Fisheries Laboratory, charts were prepared giving the daily sardine landings at Monterey and San Pedro, to be used in showing fluctuations in the sardine supply and their effect on the hours of labor of cannery employees. Similar information for salmon, shad, striped bass and albacore for the region from

Monterey to the Oregon line is being furnished for the wholesale fish dealers' organization.—*N. B. Scofield, March 5, 1934.*

FRESH FISH MARKETING ACTIVITIES

The Bureau of Commercial Fisheries is cooperating with over five thousand fresh fish dealers in creating a greater consumer acceptance and demand for fresh food fish. The principal bars to wider distribution of fishery products are the price, or rather the lack of public knowledge as to the factors that influence prices, and the lack of public knowledge of proper methods of preparation of fresh fish for human consumption.

The price question is well illustrated at any gathering where a representative of the fish industry talks on the marketing of its products. For whenever the question of price comes up, the inevitable question is asked: "Why does fish cost as much and sometimes more than meats? The ocean teems with them, they cost nothing to feed and require no care; while live stock, on which we depend for our meat supply, have to be fed, housed and cared for almost as carefully as we care for ourselves. This expense, of course, has to be absorbed by the ultimate buyer of the meat. With fish there are no such costs to be considered."

While it is true that fish are self-sufficient and do not depend upon man's efforts to feed or raise them, the process of getting them from their native element to our table is a good deal more complicated than is the case with live stock. Ask any angler sport fisherman who has spent a day in a mountain stream endeavoring to catch trout and he will tell you that though the fish are there, it is not always so easy to catch them.

Men who fish commercially encounter the same difficulty in securing catches of fish that the amateur angler does. They often go out for days at a time and return with nothing. Naturally their expenses for gear, boats and living go on just the same. These expenses are not small, particularly when we realize that the average fisherman has invested in his gear and boat between \$1,000 and \$10,000, with larger fishing gear costing as high as \$125,000. The fish he catches must help pay for this gear and also pay his wages.

Fish are highly perishable unless properly refrigerated. They must be handled by experienced and skilled men and if sent from distant points must be cleaned, boxed, iced and shipped by fast transportation at high rates. All of these charges must be added to the cost of the fish before the wholesaler or retailer can take his profit.

Also while the average person would not expect to get fresh peaches in December unless prepared to pay a premium for them, the same individual will buy fish not available in local waters, fish that are in all likelihood expressed from some distant point, and become indignant at the price asked. This indignation will find its expression in the conclusion that all fish are high-priced with the result that fish is passed by in future purchasing of food products.

Over fifty different species of excellent food fish are produced from the waters of the State. The average housewife buying fish only knows

or calls for three or four kinds and consequently nearly seventy-five per cent of the fish sold are of these four species. Depletion of these species and high prices are the natural result of such concentration of consumer demand. The lack of knowledge of the housewife of the great number of varieties of food fish and sea foods, and the many ways to properly prepare them, has led us to compile our cookery book "Five Hundred Ways to Prepare California Sea Foods."

The recipes used in our fish cookery book were contributed by leading chefs and cookery experts and were thoroughly tested before including them in the book. The index contains all the varieties of fish and sea foods taken in California. It indicates the most popular ways of preparing and refers the reader to the page whereon the recipe is found. It also gives the seasons of each variety and the months in which they are in greatest abundance.

Copies of this cookery book can be procured without charge by writing to the Bureau of Commercial Fisheries of the Division of Fish and Game, 450 McAllister Street, San Francisco.—A. A. Alstrom, *March 2, 1934.*

FEDERAL WILD-LIFE RESTORATION PROGRAM

Momentous developments with reference to the Federal Government's interest in alleviating unsatisfactory wild-life and game conditions throughout the Nation transpired in Washington in January of this year. Never, in the history of our country, has the Federal Government displayed such an interest in this problem and at no time have official branches of the Government, conservation, farm and sportsmen factions been in such unanimity of opinion as was recently evidenced in Washington.

On January 2, 1934, Secretary of Agriculture Wallace appointed the so-called President's Committee on Wild-life Restoration consisting of Thomas H. Beck, Wilton, Connecticut, chairman; J. N. Darling, Des Moines, Iowa, and Professor Aldo Leopold, Madison Wisconsin. This committee, which was charged with the consideration of a national wild-life restoration problem of the broadest scope, met continuously from January 6 to February 8 when their initial report comprising conclusions and recommendations was transmitted to the Secretary.

This committee concluded that: "A national wild-life restoration program is economically justifiable and immediately practical by utilizing submarginal and commercially unprofitable agricultural lands now contributing so largely to the surplus of agricultural projects."

Projects comprising approximately 5,000,000 acres were selected by the committee and submitted in their report for consideration. Nineteen projects embracing the restoration of migratory waterfowl breeding grounds and totaling 198,000 acres were herein included for the State of California. Foremost among these is the restoration for migratory waterfowl breeding grounds purposes of Lower Klamath Lake. In fact, so important does the committee consider this matter, that the following quotation is made from the introduction to that portion of their report relating to migratory waterfowl:

"An ironic commentary on our neglect of waterfowl nesting areas is had in the proclamation of President Theodore Roosevelt

setting aside Lower Klamath Lake, Oregon, as a sanctuary, in which he said, 'this is one of the greatest wild fowl nurseries in the United States. * * * An outdoor museum * * * which will prove of great educational value.'

"And in the report of F. L. Lathrop in 1932 which states, 'Lower Klamath Lake was drained after much difficulty and expense and dried up—devastated by numerous fires and abandoned as unfit for agricultural development.'"

Another specific project recommended by this committee that will improve migratory waterfowl conditions for California is the proposal to retire from agricultural development a large portion of the submarginal lands adjacent to Malheur Lake, Oregon, and permit them to revert into waterfowl breeding grounds.

The restoration of migratory waterfowl nesting areas throughout the Nation is the first and most immediate concern of this committee. They recommend the speedy acquisition of 4,000,000 acres of land potentially or actually suitable for this purpose, same to become inviolate when acquired. To insure immediate possession and control and still provide time for careful surveys, proper selection and construction work, the committee suggested one-year leases at 5 per cent of the purchase price with options to buy at an agreed price any time during the lease period.

The committee recommended the purchase of 5,000,000 acres of submarginal land suitable for development and management as upland game (grouse, quail, wild turkey, rabbits, etc.) areas, and advocated the ultimate acquisition of 10,000,000 acres for this purpose. Such land would not necessarily become inviolate, but regulated shooting under State supervision might later be permitted on it at such a time as the game populations become sufficient.

The purchase of at least 1,000,000 acres of areas known to comprise the nesting grounds of such song, insectivorous, ornamental and nongame birds as are becoming scarce was urged by the committee. Some instances in this connection related to the nesting sites of herons, cranes and the long-billed curlew, many of which have been encroached upon by agricultural development.

The committee recommended the acquisition of 2,000,000 acres needed for the restoration of big game animals and fur bearers, which should include the purchase of outlying farms or ranches where grazing privileges interfere with the protection of wild-life ranges. There are undoubtedly many instances in California where our deer, elk, antelope and mountain sheep may be enormously relieved under this plan.

The President's Committee also advocated the withdrawal of grazing privileges on extensive tracts of public domain, and in the national parks and forests where the acreage necessary to graze a head is too great to permit of any profit, and the repurchase of the water rights in such areas. It urged that the government take title to all reversion land in the public domain and retain same for the restoration of wild life and improvement of soil conditions.

It is the intention to carry out the above purchase program by the use of \$25,000,000 emergency funds which President Roosevelt has made available for the purpose. The committee asked that an addi-

tional similar amount be allotted from P. W. A. and C. W. A. moneys to be used for restoration and improvement of the lands acquired.

The committee finally proposed consolidation and coordination of Federal departments and bureaus having authority affecting wild life into a businesslike administration set-up to carry the plan into successful execution.

In addition to this most comprehensive and tremendously important plan of the President's Committee many other important conservation measures are now being considered in Washington. Most of these matters are contained in a message which was adopted and signed by the Chairman of the Senate Committee on Conservation of Wild-life Resources, the Chairman of the President's Committee on Wild-life Restoration, and the representatives of 47 interested organizations, at the Senate Committee hearing on January 25, 1934, and presented to the President by a select committee the following day.

This message first stressed the enthusiastic appreciation and the hearty cooperation pledged by these 47 units including sportsmen, nature lovers and farmers' organizations, representatives of the Audubon Societies, and sportsmen's magazines, and conservation commissioners to the restoration plan of the President's Committee, the essential proposals of which were included in the text of the message.

The conference unanimously approved the following measures and recommendations which were also included in the message presented to President Roosevelt.

1. The duck stamp bill prepared by the Special Senate Committee on the Conservation of Wild-life Resources, Senate Bill 1658 and House Bill 5632.

2. Senator Joseph T. Robinson's wild-life refuge bill, No. 2277: A bill to establish fish and game sanctuaries in the National forests and on other public lands, approved by the Senate committee and now on the Senate Calendar.

3. The coordination bill, introduced by the Senate committee, to coordinate conservation activities of the several Federal departments, which passed the Senate and was approved by the House committee in the last session.

4. Your stimulating order setting aside the sum of \$25,000,000 for the withdrawal of submarginal lands from commercial agriculture which suggests the use of certain portion of these lands for migratory waterfowl and upland game.

5. That appropriations should be made as authorized under the Norbeck-Andresen bill and the policy established therein for a period of 10 years (5 years have already gone) should be renewed.

6. The treaty with Canada established our duty to conserve migratory birds along their annual flight lanes within our country. When these birds reach the Mexican border, or the Gulf of Mexico, many of them cross into the domain of our sister republics to the south, particularly Mexico. We recommend that negotiations be entered into to bring about a treaty with Mexico similar in character to that with Canada.

This delegation received an enthusiastic reception from the Chief Executive, who commented with pleasure upon the novelty of its unanimity of opinion, an unprecedented occurrence in similar gatherings. Executive Officer John L. Farley and Nathan Moran, our member of the Federal Migratory Bird Advisory Board, were members of this delegation, having gone to Washington to represent California at the Senate committee hearings.

Subsequent to this meeting, there was formed in the House a Committee on the Conservation of Wild-life Resources that will operate in that body in the same manner in which the Senate committee of similar title functions. This committee is composed of 14 members. Repre-

sentative A. Willis Robertson, Virginia, is chairman, and California is fortunate in having two Representatives, Frank H. Buck, Vacaville, and A. E. Carter, Oakland, members of this committee.

At the time that this note is written, the Senate has passed the duck stamp bill, Senator Joseph T. Robinson's wild-life refuge bill, No. 2277, and the so-called coordination bill, No. 2529, which was introduced by the Senate committee. Telegraphic advice just received from Representative Carter states that the House passed these three bills on March 5 and that there is every indication that all three measures will receive executive approval inasmuch as each has received the President's endorsement.—*James Moffitt, March 6, 1934.*

1933 DEER KILL STATISTICS

Provisional deer tag returns for the 1933 season appeared on pages 79 and 80 of the January, 1934, issue of CALIFORNIA FISH AND GAME. Final compilation of deer statistics and deer tag sales for the year 1933 have been made and are included under "Reports" in this issue.—*James Moffitt, March 6, 1934.*

DEER HERD WINTERS WELL

Reports from many of the game wardens, notably from Siskiyou, Modoc and Lassen counties, and along the western flank of the Sierra Nevada indicate that the deer in these areas are coming through the winter in fine shape. This condition is due, no doubt, to the fact that the winter has been such a mild and open one with little or no snow or unusually cold weather.

Several recent reports from Modoc and Siskiyou counties indicate that in many instances the deer have not yet been driven down to their usual wintering grounds and on account of lack of snowfall, they have been able to winter at higher elevations than usual. The game wardens report from all sections that the deer are in excellent condition, and due to the open condition of the ranges loss from predatory animals has been unusually light.—*James Moffitt, March 6, 1934.*

DIVISION IMPORTS QUAIL FROM MEXICO

The advisability of importing quail from Mexico for stocking in southern California areas has been considered for some time by the Fish and Game Commission. The decision to do so was made by the Commission in August, 1933, when negotiations were commenced with the Mexican Department of Agriculture at Mexico City to waive that country's customary 35 cents per live bird export tax in favor of the State of California. The birds were to originate in Baja California and by the time local problems there were ironed out and the free export permit obtained, 1934 had arrived.

The permit was issued for 100,000 birds, and stipulated they must originate from points south of San Telmo, which is about 160 miles south of the border by road. This fact embraced a serious transportation problem. Nevertheless, when this and other difficulties had been

overcome 8000 quail were secured during the first six weeks of 1934. The Division expects to receive considerable more birds before operations cease for the season. We anticipate that the unused portion of the permit for 100,000 birds will be received after the close of the coming nesting season.

All imported quail are received by Division employees at the border, where they are checked and then transported to the State Game Farm at Chino. Here they are held under observation for from two to three weeks after which each is banded with one of the Division's bands and the birds are then liberated in suitable areas. Under present plans these Mexican quail will only be liberated in California in areas south of the Tehachapi where types of country closely approximating their native habitat obtain.—*A. E. Burghduff, February 21, 1934.*

REVISED ESTIMATE OF 1933 CALIFORNIA WATERFOWL ABUNDANCE

A preliminary note on waterfowl abundance in California during the 1933 season appeared on pages 78 and 79 of the January number of this quarterly.

It now appears in light of subsequent and more complete reports that this note, which was written before the close of the 1933 hunting season, was too optimistic.

Captain of Patrol William J. Harp reported that duck hunting in the Humboldt Bay district last season was the poorest during his six years' residence in that area. He believes that less than 25 per cent of the number of ducks present in that region three years ago were in evidence during the 1933 season. Harp reported that the widgeon was the commonest species throughout the entire past season and that the largest decrease in numbers appeared to be among sprig and mallard.

Late reports from the Sacramento Valley continue to confirm the concentration of a large number of ducks in the Butte Creek Basin region, but shooting elsewhere in the Valley, particularly in the so-called "West Side" area, between Williams, Colusa and Willows, was exceptionally poor last season due to a distinct shortage of ducks in that area. Our earlier report to the effect that Suisun Bay and marshes harbored more ducks in 1933 than in the previous year seems to be entirely confirmed by later reports. However, more recent advices from the Sonoma and Napa marshes and the San Pablo Bay region of San Francisco Bay indicate fewer ducks in that area last year than in the previous season.

Similarly later reports from the Wasco-Delano section of northern Kern County are contradictory to earlier reports we received, in that it appears that fewer birds were present there in 1933.

Game Warden E. H. Glidden, San Diego, provided a very careful check on the number of ducks killed on the City Water Department lakes and Sweetwater Lake in San Diego County which afford most of the duck shooting in that region. These reports indicate a total kill of 42,638 ducks on these lakes which formed an average of 4.3 birds per hunter. Glidden advised that in this area, the sprig is apparently the only species of duck that is holding up in numbers satisfactorily. He

states that a decided decrease in the number of the other species of ducks visiting San Diego County lakes was noted in 1933 over the previous season with the exception of redhead and ring-necked ducks, which latter species seemed to be more abundant than usual last year. With the exception of the three species named, he estimates a 50 per cent decrease in the number of ducks visiting the San Diego County lakes in 1933 over 1932.

Game Wardens J. W. Harbuck and W. S. Talbott provided detailed reports upon duck hunting success in the Salton Sea area. Harbuck's report for the southern end of the Salton Sea indicated that approximately the same number of birds were present and were bagged by sportsmen last year over the previous one. In that area, he considered widgeon and sprig to be about even in abundance and these species comprised 60 per cent of the duck population in that area. The balance was made up approximately of 15 per cent shovellers, 10 per cent teal, 5 per cent redheads and 10 per cent other species.

Game Warden Talbott reported on the Mecca section at the northern end of Salton Sea where he states that private and commercial duck clubs took more birds in the 1933 season than in the previous year, but that unattached shooters had poor success in this area. The species bagged in this area in order of abundance were sprig, widgeon, redhead and bluebill. Talbott believes that there were approximately the same number of ducks in this area in 1933 as in the previous season.

Later reports than those provided in our January issue fail to revise the statements therein contained relative to waterfowl abundance at Tule Lake and in the San Joaquin Valley, other than in the Delano-Wasco area.—*James Moffitt, March 6, 1934.*

ADDITION TO LIST OF TOTALLY EXCLUDED ANIMALS STATE IMPORTATION LAW

In accordance with the provisions of section 9 of Chapter 76, Statutes of 1933, the Fish and Game Commission and the State Department of Agriculture have added the rodent family OCTODONTIDAE to the list of totally excluded species. Therefore, this rodent family is hereby added to the list of totally excluded species listed under Regulation 1, pages 3 and 4 of "Rules and Regulations Governing the Importation of Wild Birds and Animals Into the State of California and Conditions Under Which Same May Be Kept in Confinement."

The family OCTODONTIDAE includes the subfamily Capromyinae and the genus *Myocastor* in which the nutria or coypu, *Myocastor coypus*, is classified. This South American fur-bearing rodent is the species most likely to be offered for import into California and all applications for its importation or that of other members of this rodent family will be denied.—*James Moffitt, Division of Fish and Game, San Francisco, Cal., March 2, 1934.*

STATEMENT OF INCOME

For the Period July 1, 1933, to December 31, 1933, of the Eighty-fifth Fiscal Year

Departmental income—current year:

License sales—		
Angling licenses, 1932.....	\$5,475 00	
Angling licenses, 1933.....	144,761 50	
Angling licenses, 1934.....	63 00	
Commercial Hunting Club licenses, 1933-34.....	1,750 00	
Commercial Hunting Club Operators licenses, 1933-34.....	390 00	
Deer tags, 1932.....	1,143 25	
Deer tags, 1933.....	64,038 00	
Fish Breeders' licenses, 1933.....	20 00	
Fish Importers' licenses, 1933.....	5 00	
Game Breeders' licenses, 1933.....	130 00	
Hunting licenses, 1931.....	261 30	
Hunting licenses, 1932-33.....	8,387 18	
Hunting licenses, 1933-34.....	169,726 00	
Market Fishermen's licenses, 1933-34.....	23,290 00	
Trapping licenses, 1933-34.....	911 00	
Wholesale Fish Packers' Shell Fish Dealers, licenses, 1933-34.....	805 00	
Total license sales.....		\$421,156 23
Other income—		
Contributions from importers.....	\$159 15	
Court fines.....	15,544 01	
Fish Packers' tax.....	63,121 98	
Fish Tag sales.....	368 73	
Game Tag sales.....	73 62	
Interest on bank balances.....	2,911 55	
Income from Department of Agriculture Fund—Chap. 825-33.....	45,131 65	
Kelp Tax.....	80	
Lease of kelp beds.....	1,025 60	
Miscellaneous sales.....	296 60	
Publication sales.....	218 85	
Dividends, California National Bank (50%).....	18,545 08	
Dividends, Trinity County Bank at Weaverville (12½%).....	88 75	
Total other income.....		147,486 37
Total departmental income—current year.....		\$568,642 60
Income for the General Fund:		
Filing fees, Section 710, Code of Civil Procedure.....		2 00
Grand total, departmental income and income for the General Fund.....		\$568,644 60

STATEMENT OF EXPENDITURES

For the Period July 1, 1933, to December 31, 1933, of the Eighty-fifth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive.....	\$4,179 96				\$4,179 96
Clerical and office.....	2,760 00	\$271 24	\$82 98		3,114 22
Printing—general.....		630 99			630 99
Automobile.....		177 74	132 10		309 84
Traveling.....			1,587 07		1,587 07
Postage.....			2,507 19		2,507 19
Telephone and telegraph.....			1,625 58		1,625 58
Freight, cartage and express.....			309 05		309 05
Rent.....			6,962 28		6,962 28
Accident and death claims.....			2,703 25		2,703 25
Accounting pro rata.....	2,249 98				2,249 98
Legal.....	493 56		111 56	\$65 32	670 44
Premiums on bonds.....			15 00		15 00
Publicity.....			93 97		93 97
Total administration.....	\$9,683 50	\$1,079 97	\$16,130 03	\$65 32	\$26,958 82
Bureau education and research:					
Chief.....	\$1,079 85				\$1,079 85
Clerical and office.....	960 00	\$29 73	\$22 24		1,011 97
Automobiles.....		208 82	128 83		337 65
Freight, cartage and express.....			1 23		1 23
Traveling.....			1,167 11		1,167 11
Postage.....			14 80		14 80
Library.....	540 00	3 48	21 07	\$29 18	593 73
Photography.....		3 23	70 35		73 58
Research.....	2,389 03	86 01		10 50	2,485 54
Publicity.....	1,200 00		16 29		1,216 29
Total bureau education and research.....	\$6,168 88	\$331 27	\$1,441 92	\$39 68	\$7,981 75
Bureau patrol and law enforcement:					
Chief and assistants.....	\$5,550 00				\$5,550 00
Clerical and office.....	1,590 00	\$29 67	\$9 45		1,629 12
Automobiles.....		8,848 73	4,345 77	\$2,098 80	15,293 30
Traveling.....			21,811 95		21,811 95
Postage.....			271 97		271 97
Telephone and telegraph.....			796 58		796 58
Freight, cartage and express.....			9 20		9 20
Rent.....			296 46		296 46
Captains and wardens.....	88,020 00	760 71	535 66	11 60	89,327 97
Launches.....		688 83	610 28		1,299 11
Fish planting.....	2,310 00	425 53	961 00		3,696 53
Premiums on bonds.....			207 00		207 00
Cooks.....	750 00				750 00
Game refuge guard.....	270 00				270 00
Commercial fisheries patrol:					
Chief and assistants.....	1,380 00				1,380 00
Captains and wardens.....	7,095 50	6 64	10 66		7,112 80
Launches.....	5,368 71	2,776 62	1,355 58	165 75	9,666 66
Fish cannery inspectors—seasonal.....	5,150 33				5,150 33
Traveling.....			2,436 50		2,436 50
Rent.....			379 00		379 00
Automobiles.....		97 42	188 24		285 66
Temporary help.....	17 00				17 00
Total bureau patrol and law enforcement.....	\$117,501 54	\$13,634 15	\$34,225 30	\$2,276 15	\$167,637 14
Bureau commercial fisheries:					
Chief and assistants.....	\$6,810 00				\$6,810 00
Clerical and office.....	4,796 34	\$25 01	\$17 00		4,833 35
Automobiles.....		102 08	60 43		162 51
Traveling.....			2,437 82		2,437 82
Postage.....			7 00		7 00
Telephone and telegraph.....			256 80		256 80
Freight, cartage and express.....			60 16		60 16
Rent.....			73 18		73 18
Heat, light, water and power.....			143 45		143 45
Research.....	1,140 00	24 01			1,164 01
Laboratory.....	11,203 07	397 15	371 42	\$70 23	12,041 87
Statistics.....		68 54	1,176 00	83 75	1,328 29
Temporary help.....	88 39				88 39
Total bureau commercial fisheries.....	\$24,037 80	\$616 79	\$4,603 26	\$153 98	\$29,411 83

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1933, to December 31, 1933, of the Eighty-fifth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau fish culture:					
Chief and assistants	\$3,555 00	\$13 20	\$160 50		\$3,728 70
Clerical and office	2,040 00	6 55	1 50		2,048 05
Automobiles		2,709 66	783 94	\$22 73	3,516 33
Traveling			4,443 49		4,443 49
Postage			99 16		99 16
Telephone and telegraph			493 88		493 88
Freight, cartage and express			226 35		226 35
Rent			1,523 62		1,523 62
Heat, light and power			705 90		705 90
Hatcheries	53,547 72	24,721 86	602 87	144 61	79,017 06
Fish cars	1,770 00	274 39	635 85		2,680 24
Blue printing			1 52		1 52
Cooperative research	1,575 00	246 41	1,011 63	1 15	2,834 19
Temporary help	443 00				443 00
Fish hatchery assistant—seasonal	11,753 88				11,753 88
Hydraulic engineering	1,200 00	1 12	487 59	29 21	1,717 92
Special field	3,668 96	21 94		94 79	3,786 69
Total bureau fish culture	\$79,554 56	\$27,995 13	\$11,177 80	\$292 49	\$119,019 98
Bureau game propagation:					
Chief and assistants	\$2,730 00				\$2,730 00
Automobiles		\$258 33	\$150 50		408 83
Traveling			1,210 70		1,210 70
Postage			39 01		39 01
Telephone and telegraph			101 42		101 42
Freight, cartage and express			17 96		17 96
Heat, light and power			624 09		624 09
Maintenance	6,455 71	3,539 50	242 95		10,238 16
Temporary help	405 75				405 75
Quail trapping and expansion of quail program	2,400 00	638 62	1,139 49	\$492 18	4,670 29
Total bureau game propagation	\$11,991 46	\$4,436 45	\$3,526 12	\$492 18	\$20,446 21
Bureau fish rescue:					
Chief and assistants	\$2,400 00		\$13 59		\$2,413 59
Traveling			50 82		50 82
Rent			50 00		50 00
Temporary help	69 00				69 00
Heavy truck service			506 90		506 90
Total bureau fish rescue	\$2,469 00		\$621 31		\$3,090 31
Bureau game refugees:					
Chief and assistants	\$4,249 98				\$4,249 98
Clerical and office	960 00	\$2 10	\$12 50		974 60
Automobiles		183 03	97 33		280 36
Traveling			2,136 45		2,136 45
Telephone and telegraph			95		95
Lion hunters	2,782 00				2,782 00
Refuge posting	360 00				360 00
Predatory animal control			2,460 00		2,460 00
Refuge maintenance	4,065 50	1,543 15	873 32		6,481 97
Predatory animal hunters and trappers—seasonal	2,600 00				2,600 00
Temporary help—seasonal	1,755 00				1,755 00
Total bureau game refuge	\$16,772 48	\$1,728 28	\$5,580 55		\$24,081 31
Bureau licenses:					
Clerical and office	\$6,570 00	\$23 83	\$7 35		\$6,601 18
Printing—licenses and applications		7,368 14			7,368 14
Traveling			291 44		291 44
Postage			580 98		580 98
Freight, cartage and express			448 79		448 79
Premiums on bonds			935 00		935 00
Total bureau licenses	\$6,570 00	\$7,391 97	\$2,263 56		\$16,225 53
Total 85th fiscal year expense paid from support appropriations	\$274,749 22	\$57,214 01	\$79,569 85	\$3,319 80	\$414,852 88

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1933, to December 31, 1933, of the Eighty-fifth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Special items:					
Claim of chief accounting officer of Department of Finance—Chap. 991-33				\$2,259 11	
Deer tight fences—Chap. 872-31 from July 1, 1933, to December 31, 1933				1,498 05	
Electro Metals Company's claim—Chap. 599-31				18,750 00	
License commissions				21,853 07	
State Fair and other exhibits				432 44	
Total special items					\$44,792 67
Permanent improvements:					
Construction, improvements and equipment					\$43,780 82
Prior year expense:					
83d fiscal year				\$71 70	
84th fiscal year				25,943 52	
Total prior year expense					\$26,015 22
Bureau commercial fisheries—Chap. 825-33:					
Fresh fish marketing—					
Chief and assistants	\$1,710 47				\$1,710 47
Clerical and office	479 03	\$2 15	\$11 55		492 73
Automobiles		6 50	2 50		9 00
Traveling			238 88		238 88
Postage			35 00		35 00
Telephone and telegraph			2 61		2 61
Freight, cartage and express			59 49		59 49
Rent			5 15		5 15
Exhibits		133 39	2,623 39		2,756 78
Temporary help	315 00				315 00
Total bureau commercial fisheries—Chap. 825-33, fresh fish marketing	\$2,504 50	\$142 04	\$2,978 57		\$5,625 11
Grand total proprietary group					\$535,066 70

SEIZURES OF FISH AND GAME

October, November, December, 1933

Fish:		
Abalones.....	266	
Abalones, pounds.....	4,500	
Bass, striped, pounds.....	1,962	
Bass, striped (fish).....	44	
Clams.....	3,178	
Crabs.....	244	
Cockles.....	254	
Catfish, pounds.....	10	
Lobsters, pounds.....	2,655	
Mussels, pounds.....	208	
Salmon, pounds.....	2,458	
Spears, fish.....	4	
Traps, fish.....	41	
Yellowfin, pounds.....	3,619	
Halibut, pounds.....	1,150	
Spotfin Croaker, pounds.....	400	

Game:		
Antelope.....	1	
Deer.....	20	
Deer meat, pounds.....	484	
Ducks, geese, mudhens.....	90	
Doves.....	33	
Non-game birds.....	4	
Pheasants.....	17	
Pigeons.....	39	
Quail.....	44	
Rabbits.....	2	
Shorebirds.....	151	
Swan.....	4	
Bird nets.....	2	
Guns.....	2	

GAME CASES

October, November, December, 1933

Offense	Number arrests	Fines imposed	Jail sentences (days)
Antelope; killing of.....	1	\$100 00	-----
Bear; closed season.....	2	25 00	-----
Deer; closed season; killing of does, fawns; spike buck; illegal deer tags.....	67	1,485 00	-----
Ducks; geese; closed season; selling of.....	9	350 00	6
Doves; overlimit.....	6	55 00	-----
Hunting; no license or with an illegal license.....	54	727 50	135
Non-game birds; killing of.....	8	130 00	-----
Pheasants; closed season.....	26	455 00	100
Pigeons; overlimit.....	6	400 00	-----
Quail; closed season; trapping of.....	13	410 00	-----
Rabbits; closed season; snaring of.....	4	35 00	50
Shorebirds; killing of.....	10	235 00	-----
Swan; killing of.....	6	75 00	-----
Shooting from auto, boat or highway.....	14	179 50	-----
Spotlight shooting.....	19	392 50	-----
Firearms in refuge.....	5	-----	-----
Trapping; closed season.....	1	-----	-----
Trespassing.....	11	165 00	-----
Totals.....	262	\$5,219 00	907

FISH CASES

October, November, December, 1933

Offense	Number arrests	Fines imposed	Jail sentences (days)
Abalones; small; overlimit	39	\$840 00	12
Angling without license	41	435 00	65
Bass, striped; small; overlimit; closed season	14	190 00	90
Bass, white sea; small	1	25 00	
Catfish; small	1	20 00	
Clams; small; overlimit	23	710 00	112
Crabs; small	4	125 00	
Cockles; small	3	75 00	
Commercial fishing; no license	31	75 00	22
Halibut; small	1	100 00	
Lobsters; small; trapping of	21	245 00	345
Mussels; overlimit	3		
Nets, seines; illegal use of	13	650 00	
Night fishing	1		
Salmon; untagged	9	110 00	
Illegal fishing apparatus	7	100 00	30
Trout; closed season	1	25 00	
Totals	213	\$3,725 60	676

NUMBER OF HUNTERS KILLING TWO DEER—1933

County of residence of hunter	Number of hunters	County of residence of hunter	Number of hunters
Alameda	88	Plumas	29
Alpine	1	Riverside	23
Amador	7	Sacramento	46
Butte	43	San Benito	17
Calaveras	6	San Bernardino	21
Colusa	21	San Diego	21
Contra Costa	22	San Francisco	130
Del Norte	3	San Joaquin	30
El Dorado	10	San Luis Obispo	63
Fresno	79	San Mateo	28
Glenn	17	Santa Barbara	66
Humboldt	139	Santa Clara	57
Imperial	2	Santa Cruz	29
Inyo	22	Shasta	33
Kern	63	Sierra	10
Kings	11	Siskiyou	66
Lake	11	Solano	26
Lassen	21	Sonoma	99
Los Angeles	251	Stanislaus	20
Madera	9	Sutter	10
Marin	19	Tehama	20
Mariposa	3	Trinity	8
Mendocino	62	Tulare	42
Merced	13	Tuolumne	1
Modoc	1	Ventura	40
Mono	9	Yolo	20
Monterey	80	Yuba	9
Napa	20	State of Nevada	2
Nevada	6		
Orange	33	Total	2,057
Placer	19		

SEVEN-YEAR RECORD OF DEER KILL IN CALIFORNIA

COUNTY	1927				1928				1929				1930				1931		
	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over
Alameda	171	42	7	220	198	54	11	263	105	64	6	275	161	74	17	252	192	48	8
Alpine	14	21	32	67	20	23	23	66	24	32	33	89	54	27	43	124	44	38	47
Amador	19	18	22	59	28	31	19	78	32	27	28	87	40	26	35	101	39	32	3
Butte	74	68	86	228	80	71	61	212	82	70	82	234	113	100	101	314	152	172	170
Calaveras	50	47	52	149	77	65	49	191	61	58	56	175	118	86	79	283	81	84	
Colusa	161	76	26	263	162	84	26	272	184	85	28	297	220	95	28	343	189	85	
Contra Costa	4	1		5	5	1		6	11	2	1	14	5	1		6	7	4	
Del Norte	16	12	14	42	18	10	20	48	27	13	15	55	8	19	13	40	11	12	1
El Dorado	183	173	179	535	176	183	189	548	15	21	180	597	262	227	196	685	260	209	2
Fresno	215	170	207	592	292	230	241	763	283	232	249	764	325	285	283	893	358	288	30
Glenn	284	242	97	623	280	198	114	592	06	210	70	586	301	224	76	601	226	143	1
Humboldt	389	258	174	821	336	200	151	777	284	249	156	689	393	319	205	917	525	351	19
Imperial	1			1	2		2	4	2	1	1	4			1	1			
Inyo	74	48	51	173	89	76	74	239	96	81	76	253	88	76	87	251	87	64	60
Kern	83	72	63	218	129	82	84	295	135	103	59	297	130	101	93	324	160	121	73
Kings		3		3	1		2	3	2	1		3	9	1	2	12	2	4	
Lake	599	229	73	901	695	267	76	1,038	583	194	64	841	585	227	73	885	501	172	
Lassen	20	86	190	296	26	146	221	393	35	166	310	511	35	186	364	585	26	215	
Los Angeles	279	92	54	425	256	70	43	369	470	150	71	691	437	144	56	637	678	180	
Madera	96	77	87	260	126	84	90	300	122	91	100	313	148	124	107	379	186	133	1
Marin	297	58	12	367	362	68	14	444	337	48	9	394	347	46	10	403	385	54	10
Mariposa	32	31	32	95	50	47	37	134	53	52	39	144	80	72	83	235	87	57	46
Mendocino	853	426	196	1,475	791	477	200	1,468	728	422	205	1,355	822	456	205	1,483	1,014	496	1
Merced	41	21	5	67	45	16	7	68	29	15	4	48	45	17	6	68	42	15	
Modoc		138	372	510		269	460	729		300	535	835		375	754	1,129		571	
Mono	14	7	15	36	12	11	32	55	32	20	24	76	19	25	29	73	35	30	
Monterey	541	161	55	757	536	217	77	830	502	173	59	734	577	211	76	864	635	187	
Napa	242	155	45	442	327	179	63	569	332	149	42	523	337	142	57	536	333	114	
Nevada	38	48	39	125	51	44	45	140	62	47	60	169	93	69	74	236	84	68	
Orange	24	17	15	56	36	22	11	69	50	22	9	81	49	27	14	90	73	24	
Placer	121	105	115	341	125	126	95	346	112	124	99	335	126	109	105	340	139	118	
Plumas	177	169	205	551	477	192	217	586	233	194	268	695	279	196	289	764	337	280	
Riverside	170	82	71	323	120	76	53	249	216	93	95	404	337	163	129	629	357	189	
Sacramento					1		1	2						1		2	3		
San Benito	150	54	13	217	210	90	20	320	180	67	22	269	197	89	27	313	205	54	
San Bernardino	32	21	21	74	57	34	31	122	66	29	25	120	80	50	58	188	111	63	
San Diego	95	38	36	169	120	76	36	232	114	66	53	233	141	65	44	250	175	98	
San Francisco																			
San Joaquin	13	8		21	10	4		14	18	4		22	12	7	3	22	17	5	
San Luis Obispo	251	103	40	394	290	112	48	450	255	140	60	455	353	126	89	568	347	147	
San Mateo	61	13	3	77	83	4	2	89	78	22	2	102	81	14	5	100	88	10	
Santa Barbara	424	154	91	669	526	204	121	851	445	164	108	717	471	204	102	777	506	180	
Santa Clara	243	119	35	397	371	134	31	536	403	131	43	577	461	138	51	650	515	136	
Santa Cruz	69	6	3	78	81	7	4	92	84	16	2	102	101	12	2	115	107	15	
Shasta	171	240	201	612	175	230	198	603	190	267	245	702	203	237	215	655	222	281	2
Sierra	27	27	47	101	26	30	46	102	44	42	46	132	42	38	57	137	65	47	
Siskiyou	424	491	750	1,665	450	522	682	1,654	218	366	627	1,211	270	478	624	1,372	297	517	70
Solano	22	16	7	45	30	15	7	52	81	20	3	54	41	13	4	58	34	9	
Sonoma	519	188	44	751	506	194	53	753	469	216	47	732	532	263	70	865	587	251	
Stanislaus	53	26	12	91	69	28	18	115	77	33	9	119	66	36	9	111	61	28	
Sutter			1	1	2	1		3	1	1		2		1		1		1	
Tehama	286	288	225	799	280	329	237	846	284	262	212	758	343	247	255	845	263	271	181
Trinity	299	339	283	921	295	310	195	800	234	277	240	751	249	321	190	760	309	811	221
Tulare	341	200	203	744	484	250	205	939	361	257	189	807	418	319	228	965	400	254	236
Tuolumne	64	72	77	213	74	88	51	213	70	74	68	212	100	95	85	280	116	120	93
Ventura	164	74	36	274	226	99	37	362	233	75	38	346	208	74	26	308	256	99	35
Yolo	55	39	21	115	97	46	26	169	100	49	27	176	130	61	23	214	121	57	13
Yuba	24	19	10	53	22	21	9	52	23	14	18	55	43	33	17	93	34	28	29
Totals	9,069	5,688	4,750	19,507	10,113	6,537	4,865	21,515	9,823	6,282	5,117	21,222	11,085	7,172	5,875	24,132	12,087	7,545	6,173
Deer Tag License Sales	110,760				105,638				115,472				123,999				129,005		

	1932				1933			
	2-point	3-point	4-point and over	Total	2-point	3-point	4-point and over	Total
248	125	32	7	164	111	32	5	148
129	64	65	62	191	30	51	56	137
104	25	23	16	69	28	21	17	66
404	109	94	93	287	72	69	64	205
227	63	51	34	148	40	31	43	114
304	125	51	12	198	131	61	28	220
11	6	2	8	5	3	1	9	
38	6	6	1	13	10	4	3	17
699	166	162	134	462	114	123	131	368
952	355	279	248	882	335	303	250	888
430	209	103	36	348	127	95	31	253
039	378	273	156	807	391	297	154	842
211	1	3	4	1	1	3	5	
354	71	57	52	180	135	92	70	297
	86	62	48	196	107	83	76	266
10	4	5	4	13	3	2	5	
726	332	137	55	524	322	114	45	481
607	23	192	283	508	30	218	303	551
949	598	159	62	819	426	114	32	572
442	117	89	110	316	100	82	86	268
449	323	46	7	376	258	38	5	301
190	50	43	41	134	35	35	30	100
706	710	384	179	1,273	716	372	146	1,234
60	26	13	6	45	33	9	3	45
486	345	571	916	390	565	955		
110	29	36	29	94	55	31	39	125
900	342	100	42	484	423	150	58	631
458	184	89	31	304	203	55	27	285
229	53	38	53	144	49	50	55	154
114	51	25	11	87	25	6	5	36
361	104	93	74	271	61	71	64	196
968	275	257	297	829	304	305	308	917
663	280	135	73	488	206	95	53	354
4	1	1	2	2	2	2	2	
275	106	29	17	152	109	47	16	172
237	73	45	69	187	77	38	38	153
334	142	76	45	263	93	51	29	173
24	10	2	3	15	9	4	1	14
552	226	93	58	377	271	121	44	436
103	63	19	3	785	92	12	1	105
755	345	126	61	532	354	129	64	547
687	322	76	17	415	283	92	18	393
127	67	12	6	85	96	10	2	108
773	149	176	202	527	145	199	173	517
190	45	46	60	151	51	39	68	158
516	149	300	447	896	150	288	385	823
45	17	13	1	31	14	4	1	19
903	478	180	51	709	533	173	42	748
94	25	8	4	37	27	6	4	37
1								
715	208	173	106	487	231	198	140	569
841	130	167	121	418	102	140	98	340
890	292	231	202	725	274	201	150	625
729	69	68	78	215	48	62	65	175
390	210	66	41	317	241	117	50	408
191	70	53	15	138	51	22	15	88
91	14	9	11	34	11	16	4	31
805	8,492	5,429	4,459	18,380	8,150	5,372	4,164	17,686
98,702				95,776				

County where deer was killed	Alameda	Alpine	Amador	Butte	Calaveras	Colusa	Contra Costa	Del Norte	El Dorado	Fresno	Glenn	Humboldt	Imperial	Inyo	Kern	Kings	Lake	Lassen	Los Angeles	Madera	Marin	Mariposa	Mendocino	Merced	Modoc	Mono	Monterey	Napa
Alameda	121																											
Alpine	16	8			13		6			2										1								
Amador		1	43		1		4		1											4								
Butte	4		2	157		2	5													7								
Calaveras	11				34		1													2								
Colusa	12			2		75	9				6						2		2								1	1
Contra Costa	2						7																				1	
Del Norte	1						15																				5	
El Dorado	11		23		2		4		153				1	6	31	54			10		2		1				5	
Fresno	5				1					518									145	11				3		1		
Glenn	15			29		25	3		1	1	58							14	1					2			1	
Humboldt	23	1		3		1	3	7			3	616	5	115	6	1	2	21	21		12		31	1			2	
Imperial													1															
Inyo																												
Kern																												
Kings																												
Lake																												
Lassen																												
Los Angeles																												
Madera																												
Marin																												
Mariposa																												
Mendocino																												
Merced																												
Modoc																												
Mono																												
Monterey																												
Napa																												
Nevada																												
Orange																												
Placer	18																											
Plumas	1																											
Riverside	146			8		6	20			4	9	11																
Sacramento	43			20		22	15	7	2	9	28	16	2		6	14	33	5	41	1	2	9	29	26	112		17	
San Bernardino																												
San Diego																												
San Francisco																												
San Joaquin																												
San Luis Obispo	1						1			3					12				48		1						17	
San Mateo																												
Santa Barbara																												
Santa Clara	20					1	7																					
Santa Cruz	1																											
Shasta	21			16		5	16	1		2	6	3			2	1	8	6	29		3		3	2	4		13	
Sierra	6			3			6			1				1				1	2								2	
Siskiyou	27			5		8	13	4		3	2	9	4		3	6	4		16				11		1		2	
Solano							1																					
Sonoma	41						12					1			4		1		5		21		2	6			2	
Stanislaus	1						1																					

HUNTING ACCIDENTS—1933*

	1933	1932
Number of persons killed.....	47	32
Number of persons wounded, not killed.....	99	124
Number of self-inflicted accidents—		
Fatal.....	29	17
Nonfatal.....	58	64
Number of accidents inflicted by others—		
Fatal.....	18	12
Nonfatal.....	41	53
Occurred while hunting large game (deer, bear, etc.)—		
Fatal.....	9	10
Nonfatal.....	20	26
Occurred while hunting small game (rabbit, duck, quail, etc.)—		
Fatal.....	19	12
Nonfatal.....	45	57
Occurred while hunting unknown game—		
Fatal.....	19	10
Nonfatal.....	34	41

1933 Figures only	Fatal	Nonfatal
Occurred while hunting—		
Ducks.....	2	10
Quail.....	1	8
Dove.....	3	6
Pigeon.....	1	—
Deer.....	9	20
Rabbit.....	11	18
Squirrel.....	—	2
Coyote.....	1	1

*Figures compiled from newspaper clippings.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1933
Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake.	Marin.	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore							4,850		13,515
Anchovy									
Barracuda	70								
Bonito									
Cabrilla									
Carp		12,700			2,639				
Catfish				35	42,638	38,652			
Cultus		45,466							
Flounder	20,423	1,340					152,021	17,698	51,253
Hake	4,116	1,725					42,281	894	43
Hallibut							4,625		
Hallibut—California					9,956		9,822	687	670
Hardhead		29,900					32,658		43,800
Herring			145,737						
Kelp Bass									
Kingfish									
Mackerel—Horse							3,684	1,271	71,500
Mackerel—Pacific									
Mackerel—Spanish								70	247,366
Mullet									
Perch									
Pike	1,079	427	15,846				19,199		3,137
Pompano						4			
Ray									
Rock Bass									
Rockfish	26,278	62,764							
Sablefish	301,801	23,200					156,732	111,378	322,898
Salmon	25,479						25,046	109,734	17,802
Sand Dab	6,231	16,675					72,634	12,968	2,987

Sardine.....						40,883,310	390	140,727,329
Scupin.....						7	51	77
Sea Bass—Black.....						28,315	1,245	2,085
Sea Bass—White.....								
Shark.....					27			
Sheepshead.....								
Shake.....						42,614	700	3,292
Shippack.....								
Snell.....						34,948	11,367	10,117
Snell—Jack.....							1,873	
Sole.....						1,163,670	126,913	8,818
Spittail.....						2,415		
Sucker.....						127		
Swordfish—Broadbill.....								
Swordfish—Marlin.....								
Tom Cod.....								
Tuna—Yellowfin.....								
Triplet.....						261		
Whitebat.....						7,560		
Whitefish.....						2,987		
Yellowtail.....								
Miscellaneous.....						15,448	1,978	
Total fish.....							399,157	141,530,810
Crustaceans:								
Crab.....								
Shrimp.....								
Spiny Lobster.....								
Mollusks:								
Abalone.....								
Clam—Hardshell.....								
Clam—Mixed.....								
Clam—Pismo.....								
Clam—Softshell.....								
Octopus.....								
Oyster—Eastern and Japanese.....								
Squid.....								
Totals.....							438,536	142,534,165

All amounts shown in pounds unless otherwise specified. Skipjack and Albacore cleaned.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1933—Continued

Compiled by Division of Fish and Game, Bureau of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from west coast south of the International Boundary brought into San Pedro	Fish from west coast south of the International boundary brought into San Diego	Total fish from west coast south of the International boundary brought into California
Albacore		40			40			
Anchovy		12,506	256		31,107			
Barracuda		155,730	1,283	32,546	223,644	5,300	29,828	35,118
Bonito	39,085	4,529	788	106,285	111,602	54,352	65,816	120,368
Carilla						439		439
Carp								
Catfish								
Cutlus	261	384	41		15,362			
Flounder	4	1,190	232		79,325			
Hake		100	42		287,407			
Halibut		90			50,109			
Halibut—California	77,816	17,191	6,112	4,002	6,492		43,908	43,908
Hardhead					116,300			
Herring	109			4,419	39,856			
Kelp Bass		387			226,723			
Kingfish	37	93,406	7,076	215	387			
Mackerel—Horse	3,357	719,911	488		177,189			
Mackerel—Pacific	16,505	21,038,795	370,901	2,509,759	727,937		689	689
Mackerel—Spanish					24,183,306	2,602	795	3,397
Mullet		355	19	889	1,263			
Perch	524	4,051	1,198	10	45,471	112		112
Pike								
Pompano	2	272			274			
Ray		125	428		553			
Rock Bass		12,033	14,164	31,183	61,199		421	6,251
Rockfish	3,819	287,203	29,985	72,505	1,100,165	5,830	15,603	15,603
Sablefish	30,332	85,336	85,630	704	649,316			
Salmon	63				25,479			
Sand Dab		1,360	3,675		116,470			

Sardine.....	45	91,131,768	1,179	103,863	272,636,705	71,988	68,228	141,216
Soupin.....	195	6,829	727	865	9,068	32,002	172,506	204,508
Sea Bass—Black.....	44	1,258	315	5,891	7,920			
Sea Bass—White.....	16,078	47,507	15,262	7,494	71,556			
Shark.....	1,735	7,871	880	6,415	22,000			
Sheepshead.....	4,105	12,968	357	4,647	52,305			
Skate.....		1,537	10	140	10	999,415	4,995,427	5,994,842
Skipjack.....			7,927	7,289	133,962			
Smelt.....	68	41,920		37	3,144			
Smelt—Jack.....	128	663		427	2,077,832			
Sole.....	74,461	1,256	198		10,715			
Spittail.....					9,927			
Sucker.....					311,432		36,078	36,078
Swordfish—Broadbill.....	8,943	197,460	29,915	75,114	549			
Swordfish—Marlin.....		954		606	1,560			
Tom Cod.....					510	4,145,820	12,655,704	16,801,524
Tuna—Yellowfin.....			4		8,223			
Tarbot.....					3,108			
Whitebait.....			396	7,285	25,855	803	2,531	3,334
Whitesh.....	189	17,985	190	91,894	105,411	185,734	450,991	636,725
Yellowtail.....		13,327	53	480	40,722	138	268	406
Miscellaneous.....	68	1,400						
Total fish.....	277,973	113,919,806	579,731	3,165,474	303,879,742	5,504,725	18,538,793	24,044,518
Crustaceans:								
Crab.....		2,097			796,873			
Shrimp.....					377,354			
Spiny Lobster.....	40,908	69,970	12,665	30,537	154,080	12,239	236,387	248,626
Mollusks:								
Abalone.....	144,838				746,213			
Clam—Hardshell.....		6,397	80		13,368			
Clam—Mixed.....					6,856			
Clam—Pismo.....	16,073				23,538			
Clam—Softshell.....			25		51,288			
Octopus.....					3,814			
Oyster—Eastern and Japanese.....					172,631			
Squid.....			3		336,938			
Totals.....	479,792	113,998,270	592,504	3,196,011	306,562,695	5,516,964	18,776,180	24,293,144

All amounts shown in pounds unless otherwise specified. Skipjack and abalone cleaned.

1933-ABSTRACT CALIFORNIA SPORTING FISH & GAME LAWS-1935

THIS ABSTRACT WILL BE VALID UNTIL 90 DAYS AFTER ADJOURNMENT OF THE 1935 LEGISLATIVE SESSION

OPEN AND CLOSED SEASONS

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES

GAME	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
DEER	1½													No Does, Fawns or Spike Bucks No Forked Horned Deer in Dist. 13½ No sale of Venison or Deer Skins Two Bucks per Season except in 13½ where limit is one. See Notes 6-9-10-12
	2-2½-3													
	2½-4-4½													
	4-4½-5-5½-23-25													
Rabbits—Collontail and Brush	ALL EXCEPT 4, 4½, 19, 21													15 per day, 30 per week. Season always open in 4, 4½, 19, 21
Bear, Fur Animals	ALL													See Note 7
Ducks, Geese, Jack Snipe, Mud Hens	ALL EXCEPT 15													Federal regulations will be enforced in California and will be published as soon as announced by Federal authorities. 15 Days day, 10 week, previous limit, 25 Sage day, previous limit, 100 & 100 per limit, see note 4. See notes 9 to 13, and
Quail—Valley, Desert and Mountain	ALL EXCEPT 1½													Valley - Desert - Mountain Each Variety 10 per day, 10 in possession. 20 per week
Dove	ALL EXCEPT 4-4½-4¾													15 Per Day 15 in possession 30 Per Week
Pheasant	4-4½-4¾													2 Male birds per day 2 in possession
Pigeon														10 per day, 10 in possession 20 per week

There is no open season on Elk, Antelope, Mountain Sheep, Sea Otter, Beaver, Tree Squirrel, Sierra Hare, Rail, Wood Duck, Swan, Shore Birds (except Jack Snipe), Grouse, Sage Hen, Imported Quail, Partridge, or Wild Turkey

FISH	DISTRICTS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	BAG AND POSSESSION LIMITS, ETC.
Steelhead and all Trout (except Golden) Whitefish	1-1½-1¾-2-2½-3-3½-4-4½-4¾-5													No Sale No Sparring for other restrictions See Notes 12-15-16-20 21-22-27-28 30-32 On this Card
	2½													
	23-25													
	Truckee River													
Unlawful to take trout in waters closed by Governor's proclamation	1½-5 and Winter Klamath River													5 Trout regardless of weight
	Reclus, Napa, Nevada, Ed at 2, 2½, 12½, Tidewater 2-3-15													3 Trout regardless of weight
	Sacramento River between Yuba Ferry and Middle Creek, Shasta County													3 Trout regardless of weight
Golden Trout	ALL EXCEPT 1-4½													20 per day, None under 5 inches Not more than 10 lbs. and one See Note 22
BLACK BASS	ALL EXCEPT 4¾													15 per day No limit under 4½ Clear Lake 10 per day 25 per day
Sunfish	CLEAR LAKE													No Black Bass under 9 in. No sale Hook and line only
Sacramento Perch and Crappie	ALL EXCEPT CLEAR LAKE													25 per day Hook and line only 10 per day No sale
Striped Bass	ALL													Elk River from mouth to Oroville, closed January 1st to April 30th Hatchery closed 12 miles, 5 per day, 5 in possession. Hunt in the lake from Salton Sea. See Notes 19 and 20
Crabs	ALL EXCEPT 1½-6-7-8-9													Season Districts 13½-7-8-9 December 15 to August 30 See Note 23, None under 7 inches. No Female
Abalones														Only for food. Must be brought to shore alive in shell Angling License Required. See Note 26
Pismo Clams	17													None under 5 inches. No shipment. 15 per day Angling License Required District 18a Closed
Spiny Lobster	ALL													No Sale of Meat. None under 10½ or over 16 inches See Note 23
GRUNION	ALL													

SALMON, See Note A.

STURGEON, No Open Season (possession prohibited).

NOTES

IT IS ALWAYS UNLAWFUL

1. To hunt, kill, possess wild birds or mammals, to possess firearms, except under written permit from the Commission, in Districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q, 1r, 1s, 1t, 2a, 2b, 2c, 2d, 2e, 2f, 2g, 2h, 2i, 2j, 2k, 2l, 2m, 2n, 2o, 2p, 2q, 2r, 2s, 2t, 2u, 2v, 2w, 2x, 2y, 2z, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 3i, 3j, 3k, 3l, 3m, 3n, 3o, 3p, 3q, 3r, 3s, 3t, 3u, 3v, 3w, 3x, 3y, 3z, 4a, 4b, 4c, 4d, 4e, 4f, 4g, or General Grant Refuge, or Mt. Tamalpais Game Refuge, including Richardson Bay, or San Francisco Refuge, or Silver Lake Refuge (water fowl may be killed in 4a and 4e), or to hunt quail in Bolinas Quail Refuge, or to hunt or discharge firearms in Huntington Lake Refuge, San Leandro Bay Refuge, or Monterey Peninsula Refuge.
2. To hunt birds or mammals excepting predators without a hunting license. To hunt in areas closed by proclamation.
3. To possess any bird net or to net, trap or to hold protected game or birds of any kind, their nests or eggs except under written permit from the Commission.
4. To take more than 4 geese per day, 8 per week of all varieties, and 12 Canada geese and black sea brant. To take more than 25 mud hens per day, 60 per week. To have more than 1 daily bag limit of geese and mud hens in possession by 1 person in 1 day.
5. To take or kill nongame birds, except blue jay, butcher bird, English sparrow, sharp-shinned, Cooper or duck hawk, great horned owl, linnet, crow, black-billed magpie, white pelican, shag, and in Districts 1, 2, 3, 4 and 4g, blackbirds.

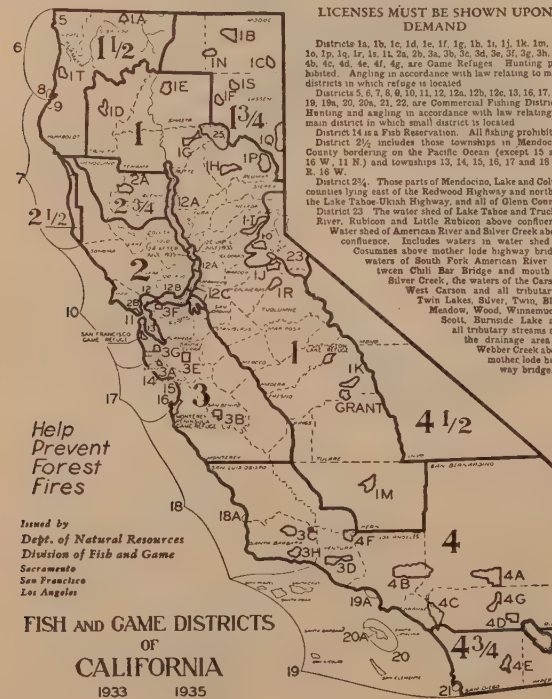
6. To hunt deer without deer tag license. To fail to attach to horns of deer immediately on killing, properly filled out deer tag or at same time to send duplicate tag to Division. To carry deer into closed district without having deer tag countersigned, or to have unsiged deer in possession. To fail to retain in possession during open season and for 10 days after, skin and portion of head bearing horns of deer killed and to produce upon demand. To use more than 1 dog to hunt in hunting deer or to allow dogs to run deer in closed season, or to possess doe or fawn skins, or deer skins not bearing evidence of sex.
7. To trap for profit without first procuring a trapping license bear, ring-tailed cat, cone, pine marten, skunk, fisher, wolverine, mink, river otter, fox or muskrat, or to kill same during closed season, except when destroying property. To interfere with traps of licensed trappers. To use saw tooth or spike-jawed traps for taking fur bearers.
8. To use any animal other than dog to stalk wild birds.
9. To shoot game from power boat, sailboat, auto, airplane, or to hunt waterfowl from scull boat in Districts 8, 9, except on Wed. and Sun., or at any time in Dist. 12 or Napa River south of Ederly Island, and in Mare Island Straits from the Napa River to Carquines Strait, or to use shotgun larger than 10 gauge, or to possess an extension automatic or cane gun. To have in possession any device capable of or to be used in silencing the report of any firearm.

10. To shoot resident game between 1 hour after sunset and 1 hour before sunrise, or migratory game between sunset and 1 hour before sunrise. To use a spotlight in hunting game.
11. To drive game birds by means of auto, airplane, or power boat over shooters.
12. To hold game or fish longer than 5 days after close of season; venison 15 days.
13. To sell wild game, except cottontail and brush rabbits.
14. To make a false statement in applying for license, to fail to show license upon demand to any officer.
15. To take game or fish from one district to another when season is not open in both. To special law for deer, trout and black bass. Trout legally taken may be transported from open district into closed district by the consignee making an affidavit in duplicate setting forth his name, address, number of angling license and name and address of consignee. Original must be attached to shipment; copy left on file with officer before whom taken. Trout may be shipped into closed district when accompanied by written statement to effect that trout were legal, signed by shipper, countersigned by agent to whom offered for shipment. Black bass legally taken may be transported from open district into closed district.
16. To ship wild birds, mammals, or fish except smoked or dried fish other than trout by parcels post, or in concealed packages or without a tag bearing name and address of consignee and consignee and contents, or to ship game out of State.
17. To operate a commercial hunting club without license.
18. To place obstructions in streams in Districts 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.
19. To sell striped bass taken with hook and line; to transport or carry striped bass out of State. To ship striped bass less than 20 in. in length or more than 10 lbs. in weight. To possess more than 5 shad per day between June 1 and Feb. 14.
20. To take trout other than with rod and line held in hand or with lure with more than 2 attractor blades or more than 3 hooks. To take trout except by angling in such manner as to cause trout to voluntarily take hook in its mouth.
21. To have in possession any fish spear or gaff (except landing gaff) within 300 feet of any lake or stream when unlawful to spear salmon.
22. To take trout in any lake within 300 feet of mouth of any stream from Oct. 31 to Aug. 1, or in that portion of any stream flowing into any lake in Districts 23 within 2 miles from its mouth, upstream, from Oct. 31 to Aug. 1. To take golden trout Cottonwood Lakes group, including South Fork Cottonwood Lakes group and 1 mile of stream below the lower lake in each of said groups, except from July 1 to Oct. 31.
23. To bring to shore crabs or lobsters in such condition that size can not be taken; or to ship or carry crabs out of Districts 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.
24. To take or possess in Districts 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.
25. To take or possess cockles less than 1 1/2 in. in diameter, or to take or possess more than 15 (Districts 2 and 10) Washington clams or more than 10 horse clams or more than 30 razor or Jackknife clams per day, or in Districts 18, 19, 21 more than 15 lbs. of mussels per day. To take or possess any Pismo clams in Dist. 18 between 1 hour after sunset and 1 hour before sunrise.

26. To possess any clam digging implement in any claim district.
27. To possess any clam digging implement in any claim district.
28. To take red abalones less than 7 in. in greatest diameter; green, 6; pink, 5; black, 5; to dry abalones; to dive for abalones in Districts 7, 15, 16, 17, 18, 19, 20, 21; to take more than 10 per day or 20 per week in Districts 7, 15, 16, 17, 18, 19, 20 and 21; to take more than 10 per day from shore in Districts 7, 10 and 18; to take more than 10 black abalones per day in Districts 15, 16, 17, 18, 19, 20, 21. To possess more than 10 per day in Dist. 2.
29. To fish for game fish without having an angling license.
30. To take game fish between 1 hour after sunset and 1 hour before sunrise in Districts 1, 15, 16, 17, 18, 19, 20 and 21.
31. To take striped bass by hook and line between sunset and sunrise.
32. To fish with nets except in commercial districts or to injure any legal net.
33. To fish through ice for fish or to take fish in Dist. 14.
34. To place, cause to be placed, or discharge into any waters substances deleterious to fish or plant life.
35. To fish within 250 ft. of fishway or 150 ft. of upper side of fish screen, or lower side of dam, or to take fish except salmon within 1 mile of spawning station when station is in operation.
36. To kill, injure or capture Cal sea lions in Districts 19, 20, 20A.
37. To take invertebrates or marine plants in Hopkins Marine Refuge (Monterey Co.) or in that area between the west line of the property of the Scripps Institute and a line 1,000 feet west of low tide line (San Diego).
38. To take more than 5 white sea bass from May 1 to June 30, or to take at any one time more than 5 under 28 in.
39. To take more than 5 herring less than 5 in. each, or to take more than 5 herring less than 3 in. each.
40. To take frogs less than 4 in. in length measured from tip of nose to posterior end of body, or to take more than 5 per day or 25 per week in Districts 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

NOTE A.—SALMON. Salmon can not be taken on spawning beds, or within 10 miles of spawning station, or 3 miles north and south of mouth of Klamath River. All salmon must have landing tags, no Chinook or steelhead or silver less than 14 in. can be taken in ocean and Humboldt Bay Districts. Underlined salmon may be refilled or clubbed, or brought ashore in such condition that size can not be determined. Salmon may be taken with hook and line in any district when trout season for said district is open.

In Dist. 1, salmon may be taken with hook and line or spear between May 29 and Oct. 31, except (a) in Feather River from its mouth to mouth of the Yuba; (b) in American River from its mouth to Fair Oaks bridge. In Dist. 2, (c) in Russian River and Navarro River; (d) in Sol River and (e) in Eel River. In Districts 2, 3 and 15, with hook and line from May 1 to last day of Feb., bag limit 3 per day. In Districts 2, 3 and 15, with hook and line from April 1 to last day of Feb., bag limit 2 per day. In Districts 2, 3 and 15, with hook and line from April 1 to last day of Feb., bag limit 2 per day. In District 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.



LICENSES MUST BE SHOWN UPON DEMAND

Districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1p, 1q, 1r, 1s, 1t, 2a, 2b, 2c, 2d, 2e, 2f, 2g, 2h, 2i, 2j, 2k, 2l, 2m, 2n, 2o, 2p, 2q, 2r, 2s, 2t, 2u, 2v, 2w, 2x, 2y, 2z, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 3i, 3j, 3k, 3l, 3m, 3n, 3o, 3p, 3q, 3r, 3s, 3t, 3u, 3v, 3w, 3x, 3y, 3z, 4a, 4b, 4c, 4d, 4e, 4f, 4g, 4h, 4i, 4j, 4k, 4l, 4m, 4n, 4o, 4p, 4q, 4r, 4s, 4t, 4u, 4v, 4w, 4x, 4y, 4z, 5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j, 5k, 5l, 5m, 5n, 5o, 5p, 5q, 5r, 5s, 5t, 5u, 5v, 5w, 5x, 5y, 5z, 6a, 6b, 6c, 6d, 6e, 6f, 6g, 6h, 6i, 6j, 6k, 6l, 6m, 6n, 6o, 6p, 6q, 6r, 6s, 6t, 6u, 6v, 6w, 6x, 6y, 6z, 7a, 7b, 7c, 7d, 7e, 7f, 7g, 7h, 7i, 7j, 7k, 7l, 7m, 7n, 7o, 7p, 7q, 7r, 7s, 7t, 7u, 7v, 7w, 7x, 7y, 7z, 8a, 8b, 8c, 8d, 8e, 8f, 8g, 8h, 8i, 8j, 8k, 8l, 8m, 8n, 8o, 8p, 8q, 8r, 8s, 8t, 8u, 8v, 8w, 8x, 8y, 8z, 9a, 9b, 9c, 9d, 9e, 9f, 9g, 9h, 9i, 9j, 9k, 9l, 9m, 9n, 9o, 9p, 9q, 9r, 9s, 9t, 9u, 9v, 9w, 9x, 9y, 9z, 10a, 10b, 10c, 10d, 10e, 10f, 10g, 10h, 10i, 10j, 10k, 10l, 10m, 10n, 10o, 10p, 10q, 10r, 10s, 10t, 10u, 10v, 10w, 10x, 10y, 10z, 11a, 11b, 11c, 11d, 11e, 11f, 11g, 11h, 11i, 11j, 11k, 11l, 11m, 11n, 11o, 11p, 11q, 11r, 11s, 11t, 11u, 11v, 11w, 11x, 11y, 11z, 12a, 12b, 12c, 12d, 12e, 12f, 12g, 12h, 12i, 12j, 12k, 12l, 12m, 12n, 12o, 12p, 12q, 12r, 12s, 12t, 12u, 12v, 12w, 12x, 12y, 12z, 13a, 13b, 13c, 13d, 13e, 13f, 13g, 13h, 13i, 13j, 13k, 13l, 13m, 13n, 13o, 13p, 13q, 13r, 13s, 13t, 13u, 13v, 13w, 13x, 13y, 13z, 14a, 14b, 14c, 14d, 14e, 14f, 14g, 14h, 14i, 14j, 14k, 14l, 14m, 14n, 14o, 14p, 14q, 14r, 14s, 14t, 14u, 14v, 14w, 14x, 14y, 14z, 15a, 15b, 15c, 15d, 15e, 15f, 15g, 15h, 15i, 15j, 15k, 15l, 15m, 15n, 15o, 15p, 15q, 15r, 15s, 15t, 15u, 15v, 15w, 15x, 15y, 15z, 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h, 16i, 16j, 16k, 16l, 16m, 16n, 16o, 16p, 16q, 16r, 16s, 16t, 16u, 16v, 16w, 16x, 16y, 16z, 17a, 17b, 17c, 17d, 17e, 17f, 17g, 17h, 17i, 17j, 17k, 17l, 17m, 17n, 17o, 17p, 17q, 17r, 17s, 17t, 17u, 17v, 17w, 17x, 17y, 17z, 18a, 18b, 18c, 18d, 18e, 18f, 18g, 18h, 18i, 18j, 18k, 18l, 18m, 18n, 18o, 18p, 18q, 18r, 18s, 18t, 18u, 18v, 18w, 18x, 18y, 18z, 19a, 19b, 19c, 19d, 19e, 19f, 19g, 19h, 19i, 19j, 19k, 19l, 19m, 19n, 19o, 19p, 19q, 19r, 19s, 19t, 19u, 19v, 19w, 19x, 19y, 19z, 20a, 20b, 20c, 20d, 20e, 20f, 20g, 20h, 20i, 20j, 20k, 20l, 20m, 20n, 20o, 20p, 20q, 20r, 20s, 20t, 20u, 20v, 20w, 20x, 20y, 20z, 21a, 21b, 21c, 21d, 21e, 21f, 21g, 21h, 21i, 21j, 21k, 21l, 21m, 21n, 21o, 21p, 21q, 21r, 21s, 21t, 21u, 21v, 21w, 21x, 21y, 21z, 22a, 22b, 22c, 22d, 22e, 22f, 22g, 22h, 22i, 22j, 22k, 22l, 22m, 22n, 22o, 22p, 22q, 22r, 22s, 22t, 22u, 22v, 22w, 22x, 22y, 22z, 23a, 23b, 23c, 23d, 23e, 23f, 23g, 23h, 23i, 23j, 23k, 23l, 23m, 23n, 23o, 23p, 23q, 23r, 23s, 23t, 23u, 23v, 23w, 23x, 23y, 23z, 24a, 24b, 24c, 24d, 24e, 24f, 24g, 24h, 24i, 24j, 24k, 24l, 24m, 24n, 24o, 24p, 24q, 24r, 24s, 24t, 24u, 24v, 24w, 24x, 24y, 24z, 25a, 25b, 25c, 25d, 25e, 25f, 25g, 25h, 25i, 25j, 25k, 25l, 25m, 25n, 25o, 25p, 25q, 25r, 25s, 25t, 25u, 25v, 25w, 25x, 25y, 25z, 26a, 26b, 26c, 26d, 26e, 26f, 26g, 26h, 26i, 26j, 26k, 26l, 26m, 26n, 26o, 26p, 26q, 26r, 26s, 26t, 26u, 26v, 26w, 26x, 26y, 26z, 27a, 27b, 27c, 27d, 27e, 27f, 27g, 27h, 27i, 27j, 27k, 27l, 27m, 27n, 27o, 27p, 27q, 27r, 27s, 27t, 27u, 27v, 27w, 27x, 27y, 27z, 28a, 28b, 28c, 28d, 28e, 28f, 28g, 28h, 28i, 28j, 28k, 28l, 28m, 28n, 28o, 28p, 28q, 28r, 28s, 28t, 28u, 28v, 28w, 28x, 28y, 28z, 29a, 29b, 29c, 29d, 29e, 29f, 29g, 29h, 29i, 29j, 29k, 29l, 29m, 29n, 29o, 29p, 29q, 29r, 29s, 29t, 29u, 29v, 29w, 29x, 29y, 29z, 30a, 30b, 30c, 30d, 30e, 30f, 30g, 30h, 30i, 30j, 30k, 30l, 30m, 30n, 30o, 30p, 30q, 30r, 30s, 30t, 30u, 30v, 30w, 30x, 30y, 30z, 31a, 31b, 31c, 31d, 31e, 31f, 31g, 31h, 31i, 31j, 31k, 31l, 31m, 31n, 31o, 31p, 31q, 31r, 31s, 31t, 31u, 31v, 31w, 31x, 31y, 31z, 32a, 32b, 32c, 32d, 32e, 32f, 32g, 32h, 32i, 32j, 32k, 32l, 32m, 32n, 32o, 32p, 32q, 32r, 32s, 32t, 32u, 32v, 32w, 32x, 32y, 32z, 33a, 33b, 33c, 33d, 33e, 33f, 33g, 33h, 33i, 33j, 33k, 33l, 33m, 33n, 33o, 33p, 33q, 33r, 33s, 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